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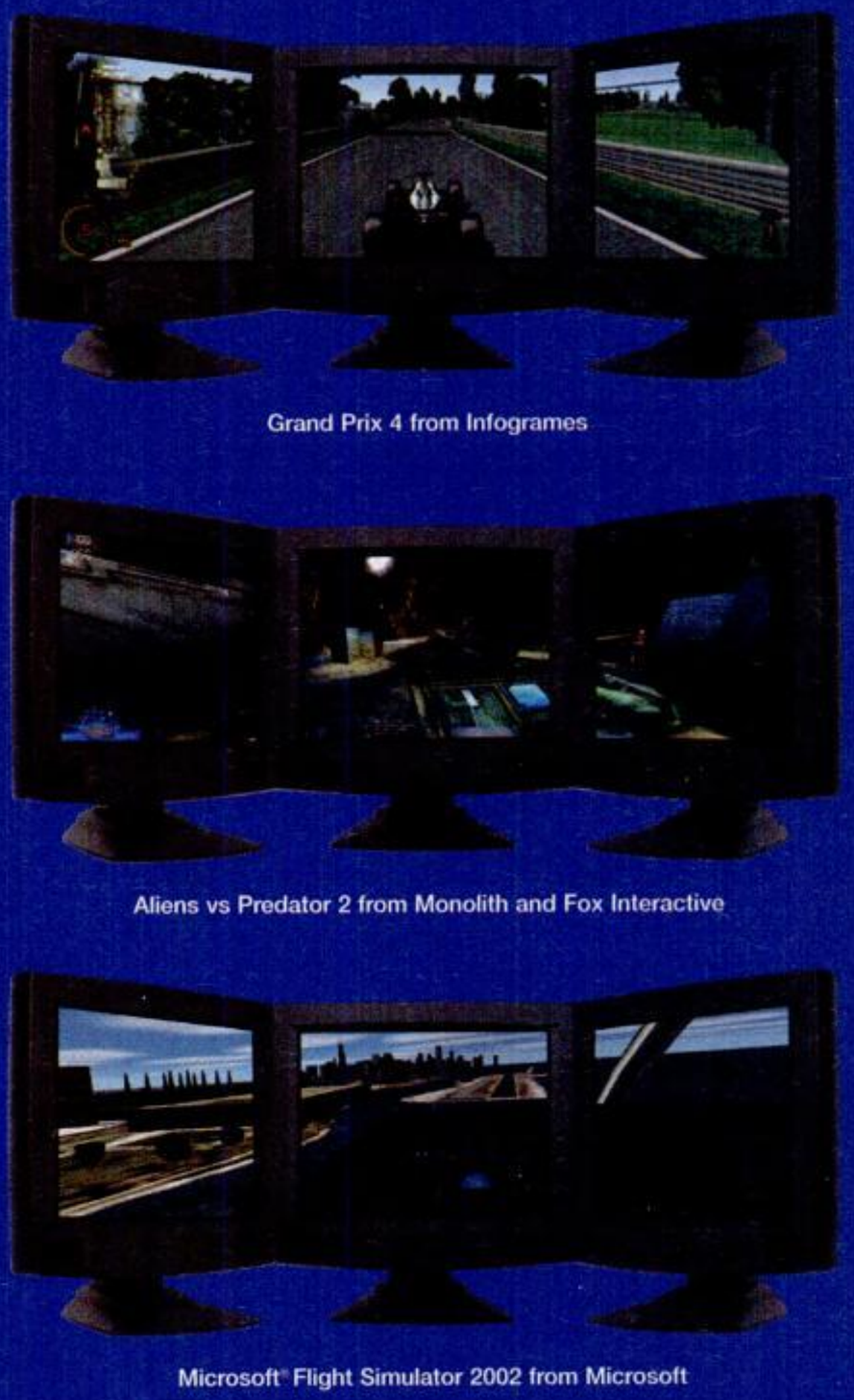

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Release Notes

Thanks for the save, Major Folgate

True story, I kid you not: I write this at the 11th hour—just minutes before our "final-final, drop-dead deadline." If I don't finish my Release Notes immediately, there will be hell to pay (in addition to an expensive late-charge from the printer in Minnesota). The problem is, I can't find adequate words to describe *Maximum PC's* reaction to September 11th, one year later. But then a piece of e-mail arrives in my in-box, and sums up anything I ever could have written—except 100 percent better.

No, the fellow in the picture above isn't me. The fastest thing I've ever driven stays on the ground (usually, hopefully), and tops out at 140mph. The guy in the photo is Major Mike Folgate, USMC, and what he wrote to us made the staff's day:

"I have been reading your magazine for about a year now. Very nice, very direct; just the way a Marine likes it. Here's a shot of me flying over Afghanistan today. I brought the most current copy out with me for those moments when action is at a lull. Thanks for producing such a wonderful magazine. Don't you guys ever hold back or buy into commercialism. I trust your every word, and I built my last PC based on a lot of things I read in your mag, such as using the PT4-E motherboard, which was a start for building an ultimate gaming rig. As you can see, I actually fly the real ultimate gaming rig."

What more can one say? Here's this guy, risking his life overseas, yet he still finds time to thank *us*. I always find it hard to believe that *Maximum PC* means so much to so many people—we're just a little-old magazine, after all. But it's inspiring to know that we've done something, anything to help out. PCs aren't very important in the big cosmic scheme of things, but the opportunity to pursue one's own dreams, hobbies, and lifestyles—computer-oriented or not—is what people like Major Folgate are working to protect.

Thanks, Mike. And thanks to all the readers who've supported and enjoyed *Maximum PC* throughout the past five years.

—JON PHILLIPS

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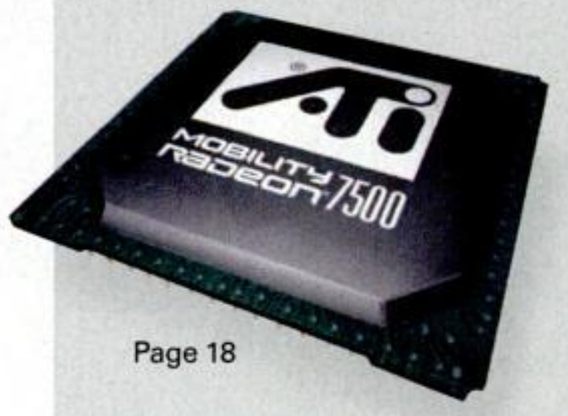

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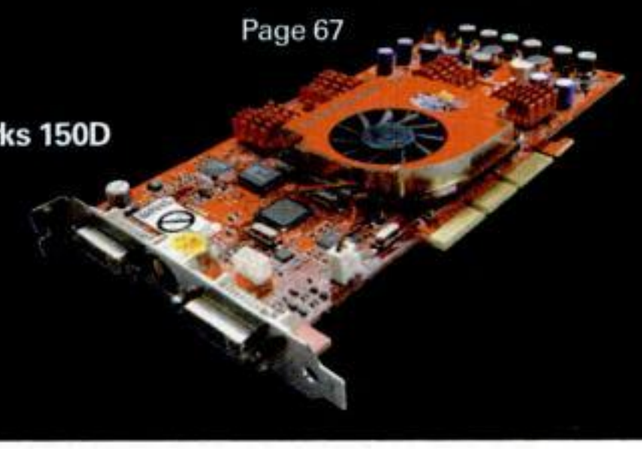

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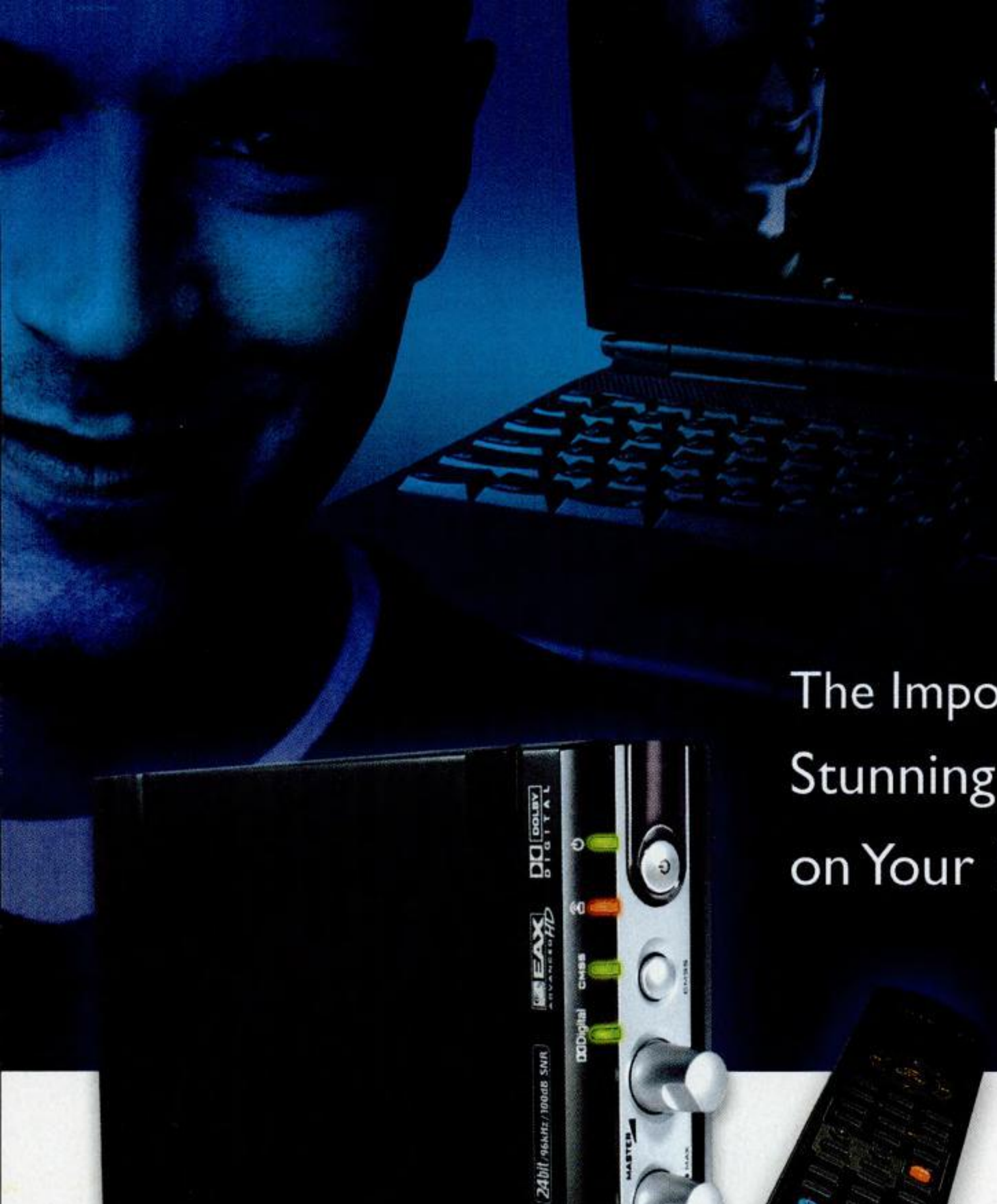

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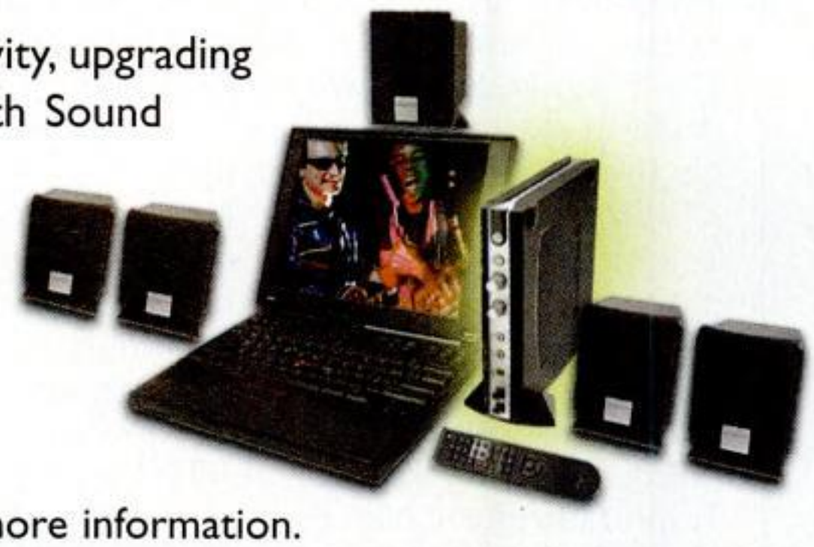

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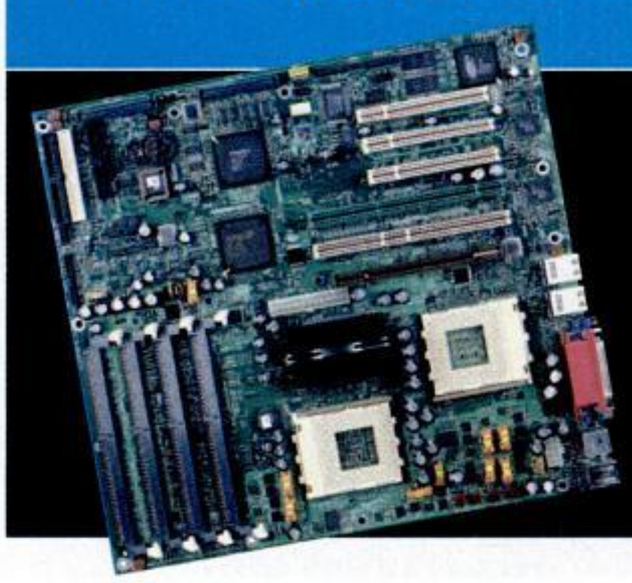

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In/Out

You write, we respond

Hardcore Software

Am I the only one to notice you had Asia Carrera do the *Photoshop* review in the July issue? Why didn't you feature any pictures of her? I know she probably doesn't need any touching up, but it sure would have been better than looking at Jon's eyelid. Am I wrong?

—GAREY MAIB

EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Most readers probably aren't aware that adult-film star Asia Carrera is also a big-time PC geek—the self-proclaimed "nerd of porn." She singlehandedly maintains her own web site, builds her own PCs, and frags mercilessly in *Unreal Tournament*. She's also a long-time *Maximum PC* reader, and doesn't need any surgery (even digital surgery) around her eyes. We didn't run any pics of her in July, because *Photoshop*—not the author—was the focus of the review. But lest there be any doubt that "our" Asia Carrera is the "real" Asia Carrera, here's a pic. We still can't decide which is cuter: Asia, the kitty, or the heatsink.

THREE MONITORS, TWO QUESTIONS

Will Smith's article "Matrox Strikes Back" (July 2002) caught my attention right off the magazine rack! It's amazing that a videocard

"This talk about anisotropic filtering and its superior detail is going too damn far!"

manufacturer is willing to push the envelope and not be timid about cutting back where all others are forging ahead (core clock speed). I can't wait to pick up this card! However, I have two concerns: First, you reviewed the card with the three-way video connection using three flat-panel monitors of the same size. Will it be possible to use, say, a 19-inch CRT for the center and two 15-inch CRTs for the sides (desk space is not an issue)? Second, while Will had high aspirations that 300MHz would be the low-end memory speed, how much of a performance decrease would there be if Matrox is stating that the memory clock speed is 275MHz at retail?

—DAN FOERST

TECHNICAL EDITOR WILL SMITH REPLIES: The Parhelia supports a limited number of configs in three-monitor mode. You can run either a DVI or analog display on the primary connector, but the secondary and tertiary connectors must run analog displays; you can't run two DVI and one analog. In two-monitor mode, however, you can run two DVI displays if you please. You can use any size monitors you want, but during gameplay we were only comfortable running three displays of the same size.

When we were gathering info for the July cover story, Matrox was confident that the board would ship at higher core and memory clock speeds than it eventually did. If you want to know how this shortcoming affected benchmarks, turn to page 60 for a full review.

SWEATING THE FINE DETAILS

I built my first PC based on the advice in your mag, and enjoy new technology as much as the next geek. But, holy crap, how much is too much? For example, this talk about anisotropic filtering and its superior detail is going too damn far! Take for example the Parhelia article in July: You needed to examine a magnified portion of a wall (150 feet away from the camera) to see a difference. If I was truly driving a 4x4 down a dirt road at a decent speed, I wouldn't be able to make out the fine lines in a wall anyway. Why should I care, as long as it looks realistic and, as you mentioned, is "sharp and in focus" when close up? Similarly, when I need to use a magnifying glass to look for the "jaggies," are they for all intents and purposes really there?

—BILL

TECHNICAL EDITOR WILL SMITH REPLIES: When we talk about visual quality in the magazine, we always like to point to specific examples and use actual in-game screenshots to illustrate the new videocard features. Enabling the two features you mentioned, anti-aliasing and anisotropic filtering, produces immediately noticeable improvements in visual quality when you're playing a game. These improvements, however, aren't always immediately visible in our magazine's rudimentary four-color screenshots.

The simple fact is that whenever you run along a wall in a first-person shooter, the textures painted on the wall become more and more distorted as you look further down the wall; anisotropic filtering addresses this problem. Meanwhile, anti-aliasing doesn't just remove jaggies, it also removes the ugly shimmering you see in high-detail scenes with lots of straight edges. At *Maximum PC*, if we can enable any features that improve visual quality

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without frame rates dipping below 60 per second, we'll do so.

PRIMORDIAL PARHELIA?

After reading your July article about Surround Gaming, I couldn't help but point out where I first saw the concept. Back in 1983, Atari released a coin-op racing game called TX-1, in which three TV screens were used to create an immersive gaming experience. Pretty neat. Now if only I could use the upcoming Matrox card to build the ultimate gaming "booth" for my room.

—ADAM CHRISTOPHER MOREAU

BIG DRIVES, BIG MYSTERIES

I was sure that I read a small paragraph in your magazine awhile back that stated the maximum capacity for IDE hard drives was around 137GB [Quick Start, September 2001]. I just saw that Maxtor came out with a 160GB IDE hard drive. So am I remembering the article incorrectly? If not, how did Maxtor do it?

—JUSTIN SCULLY

FEATURES EDITOR LOGAN DECKER ILLUMINATES: The maximum capacity for IDE hard drives *was* 137GB, just like 33GB was the maximum capacity a couple years ago, and 8.4GB before that. But new storage demands are always being placed on our PCs, and the massive drives of yesterday seem downright puny today.

The 137GB barrier was a result of the 28-bit addressing method of the ATA-5 spec. The spec could accommodate just 268,453,456 sectors, each with 512 individually addressable bytes of data. Using our own high-powered Windows calculator, we can see that 512 x 268,453,456=137,448,169,472—or approximately 137.4GB of data.

There are two main ways to break these capacity barriers. Manufacturers can implement workarounds, such as the Int13h extensions introduced to overcome the 8.4GB limit. Or they can wait for the next IDE spec to be adopted. Maxtor, which introduced its 160GB IDE drive last year, did both. Maxtor proposed to the shadowy committee that handles the ATA standard that the next revision—ATA-6—should move from 28-bit addressing to 48-bit addressing.

Until the ATA-6 spec gets drilled into our mobos, there's a workaround. All you need to take advantage of the 160GB drive is a motherboard with a recent Intel chipset and the Intel Application Accelerator utility. If you don't have an Intel chipset, you'll have to spring for an Ultra ATA/133 PCI card that supports 48-bit LBA (logical block addressing). Drives that use 48-bit addressing can hold up to 144 petabytes of information (that's 144,000,000GB of data).

New storage demands are always being placed on our PCs, and the massive drives of yesterday seem downright puny today.

THE WAY OF IAA

In your July 2002 issue, you refer to the Intel Application Accelerator (IAA) in several different articles. Although I use IAA, and you recommend using it, is there a discernable performance benefit to doing so? I have a P-III 933 system running Windows XP with 512MB of PC133 RAM, an IBM 45GB Deskstar drive, and an older Quantum 13GB drive. What does the IAA give me that I wouldn't have otherwise? How does the Intel Application Accelerator do its thing?

—ERIC J. DERITIS

SENIOR EDITOR GORDON MAH UNG RESPONDS: Under Windows XP, the IAA doesn't offer the advantages that it does

LETTERS POLICY: ***MAXIMUM PC*** invites your thoughts and comments. Send them to **input@maximumpc.com**. Please include your full name, town, and telephone number, and limit your letter to 300 words. Letters may be edited for space and clarity. Due to the vast amount of e-mail we receive, we cannot personally respond to each letter.

Conventional Wisdom

The Matrox Parhelia

Our opinions of Matrox's new videocard can be found on page 60, but what's the public buzz? The comments below were offered *before* most Parhelia benchmark results were ever made public.

Visual quality over frame rates? Sign me up! I have been longing for a new innovation in gaming immersion. As soon as I have the dough, I will own a Parhelia and three monitors.

—RYAN BURKE

I think visual quality is extremely important in every aspect of computing, and I'm willing to buy a Parhelia just to support Matrox's effort to force the issue. If the chip is strong enough to handle tomorrow's games at 1024x768 with the goodies turned on, I'm in!

—CHARLIE ROCH

Visual quality is worth more then frame rates to me. That's why I bought a Matrox G450 after having read countless reviews and user feedback.

—ANDREW BARNES

To me, the EXPERIENCE is what's important, and I was DROOLING over the mag when I saw true, wide-aspect gaming. This FPS crap is the same as the CPU megahertz crap. Anything over 50 or 60fps is cream.

—CHRIS TAYLOR

I am completely behind what Matrox is doing to the graphics scene. I'll never buy a Parhelia, but I agree that things need to be mixed up a little.

—JEROLD K. BILLINGS

If a company is going to go after industry leaders, they should go for the throat. The first Parhelia offering should have been a big enough bully to cause nVidia and ATI to quake in their boots.

—GARY KETTLEWOOD

This chipset is simply underpowered, even in the high-resolution, full eye-candy, 16x FAA department. Perhaps with a process shrink and some faster RAM, Matrox can contend with the R300 and NV30 sometime early next year.

—PHALANX28

It costs too much for the benefits it might bring me. I have no interest in Surround Gaming. I couldn't afford the extra monitors. The 10-bit Gigacolor feature is tempting, but the poor 3D performance/price ratio is hard to swallow.

—NATHAN BIEHL

The argument of visual quality over frame rates is a good one, as anything that can run over 100fps at 1600x1200 is overkill. Still, if the Parhelia can't put down at least 80fps, it isn't going to sell well when marketed as a "gaming" card.

—STUART ANDERSON

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Reader Letters

under, say, Windows 2000, but it does address the 137GB limit on IDE drives that was imposed by earlier versions of the OS. The IAA is also reported to take advantage of the Pentium 4's data prefetching feature, which essentially anticipates which bits of data the CPU is likely to request next, and then transfers the data into cache before the processor actually requests it. For your P-III, however, data prefetching doesn't apply.

Some people have reported better performance with IAA, while others complain that boot times under Windows XP actually get worse. Either way, it's a moot issue because Intel has stopped updating its Ultra ATA driver for its chipsets—if you want the latest ATA drivers for Intel boards, you have to run the IAA.

NO NTFS?

I have been subscribing to and reading *Maximum PC* for about four years now. Since XP was released, you've been preaching the use of the NTFS file system.However, the *Diskeeper 7.0* review in the August 2002 issue clearly shows the c:\volume as FAT32. Why not practice what you preach?

—JEFF LISTER

TECHNICAL EDITOR WILL SMITH REPLIES: The machine I tested that software on was my own Imagine Media–issued desktop machine (not a Maximum PC Lab machine), and its hardware config predates the advent WinXP. The rig originally ran a Win2000 install, then was later upgraded to WinXP Pro. As I'm sure you're aware, a "FAT32 c:drive, and NTFS for everything else" install was the preferred configuration for Win2000. I just haven't had the time to do a complete wipe and reformat of this machine. But, indeed, you caught me!

QBM QUERY

Do you have any updates on the quad-band memory (QBM) that Kentron was planning to release sometime this summer? I was reviewing my issues of *Maximum PC* and came across the article in the April issue.

—CHRIS BAUMGARDNER

SENIOR EDITOR GORDON MAH UNG RESPONDS: Funny you ask. We recently talked to Kentron to find out what the deal is with QBM memory. The company said it has a big announcement planned, but could say no more. We optimistically take that to mean that we'll be seeing QBM support from a major chipset vendor (whether AMD or Intel, we don't know) very soon.

THANKS FOR THE MEMORY

I'm a little confused about the article regarding the new P10 processor from 3Dlabs [August 2002]. On page 47, the article talks about how the P10 will be able to use system memory as virtual memory. How is that anything new? Wasn't the point of the AGP bus when it first debuted to let the graphics card take advantage of system memory if the card used up its available RAM? Since those were the days of EDO and PC66 SDRAM, this process simply ground PCs to a snails pace. My original Riva TNT and my current GeForce2 MX 400 both have in their Properties menu the line, "Use up to (value) MB of system memory for textures in PCI mode."

—DONALD BENSON

3DLABS REPLIES: In the past, using texture maps in system memory over AGP would be very slow because accessed textures would be repeatedly read over the AGP bus—which is significantly slower than onboard memory. In contrast, the Wildcat VP [P10] implements a genuine demand-paged virtual memory subsystem. Consequently, accessed textures not present in onboard memory are automatically accessed across AGP just once, and then cached in onboard memory for efficient access. Essentially, the virtual memory subsystem turns onboard memory into a large L2 cache which holds an optimal working set of texture pages. Texture handling simply doesn't get more efficient than this!

Analog LCD interfaces offer no benefits whatsoever. They're only helpful when running a videocard that lacks DVI.

DVI VS. ANALOG: NO CONTEST

After reading your August LCD showdown article, I was all ready to order the Sharp LL-T1820, to which you awarded a Perfect 10 verdict. But something is holding me back. That "something" is the information found in a PDF file on Sharp's web site. Its performance chart seems to indicate that only about half the display modes are available when using the DVI connection as opposed to using the analog connection. In particular, the refresh rate is slower when using DVI at maximum resolution.

Isn't a DVI connection generally supposed to be "better" than a VGA

CUT, COPY, PASTE

➤ **In our August 2002 issue, we incorrectly listed the URL for Monarch Computer. The correct URL is www.monarchcomputer.com.**

➤ **In our July 2002 Head2Head between the Jornada and Clie PDAs, the winner in the OS category was said to be "Clie" in one section, and "Tie" in the other. The fact is, the OSes are on par—it was a tie.**

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connection? Isn't digital preferred to analog? Can we get a follow-up to the LCD showdown article, with something giving the pros and cons of DVI and analog connections for LCD monitors?

—BILL BRUCHERT

EDITOR-IN-CHIEF JON PHILLIPS REPLIES: LCD monitors don't actually have refresh rates. Their pixels are either on or off. When there's no movement onscreen, their pixels remain static. And when video or game content does move onscreen, LCD pixels simply switch to different color combinations (hopefully, they do so quite rapidly in order to prevent streaking).

So why do LCD companies even list display modes and refresh rates? Because even though LCD monitors don't refresh per se, they still have to be able to accept a compatible signal from standard videocards—and videocards are designed with preset resolution/refresh combinations.

If memory serves, the Sharp flat-panel I reviewed last month likes running at either 60Hz or 75Hz in DVI mode. Performance does not degrade at 60Hz. It looks exactly the same as it does at 75Hz. It just expects a certain 1280x1024 signal, and is tuned to accept those running at 60Hz and 75Hz, because at least one of these signals is guaranteed to be offered on all DVI videocards.

Some videocards don't offer DVI. They're analog only. And it's very possible the Sharp accepts a wider range of scan options in analog mode. No specific scan option looks better than the next. You should just be concerned with a panel's resolution, and in some cases, how well the LCD interpolates lower resolutions.

Analog LCD interfaces offer no benefits whatsoever. They're only helpful when running a videocard that lacks DVI. ■

COMING NEXT MONTH

IN THE AWESOME SEPTEMBER ISSUE OF MAXIMUM PC

THE GAMING ISSUE

The world of PC gaming is about to blow up big-time, so you best be ready for the paradigm shift! Our three-pronged cover story will prepare you for all the action...

NEXT-GEN GAME ENGINES

We give you in-depth tech previews of all the 3D engines that will be powering the future's hottest games. This is where the action starts: Crafty AI, stunning lighting effects, and the most complex 3D models ever. We're approaching *Toy Story*–quality graphics—can your videocard handle the stress?

VIDEOCARD GRUDGE MATCH

Let's settle the videocard decision once and for all. Next month we test the hell out of the finest 3D accelerators from nVidia, ATI, Matrox, and any other company that's ready to play ball with the Maximum PC Benchmarking Team. May the fastest card win!

GAMING PC SHOWDOWN

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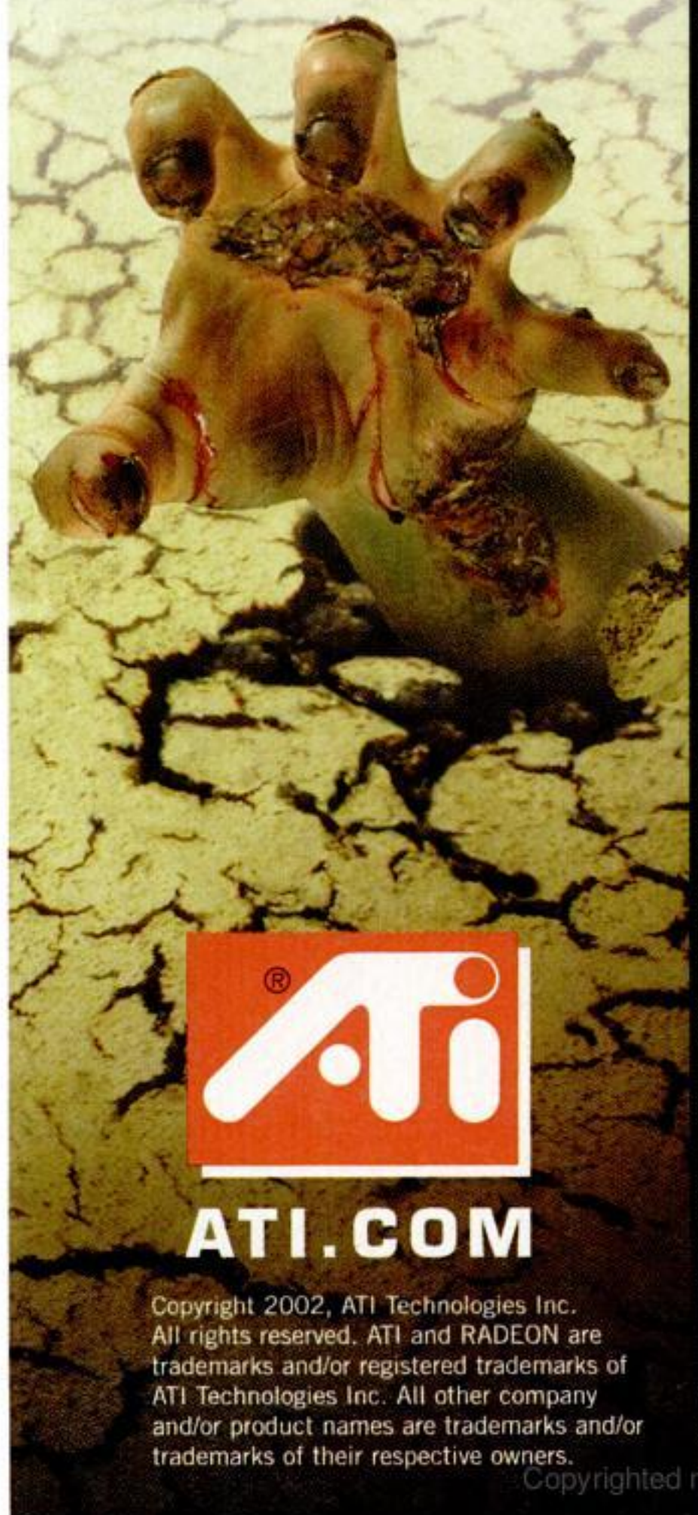

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*ATI's RADEON™ 9700 128MB DDR compared with Nvidia Geforce 4 Ti4600 128MB DDR, as measured by Unreal Performance Test v918 and 3DMark 2001 SE. Tested on the following system: P4-2.4GHz CPU, Intel 850e chipset, 512MB PC800 memory, Windows XP Professional with ATI driver v.Alpha1 and NVIDIA driver v2832. Resolutions: 1024x768 and 1280x1024

RADEON 9700

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Quick Start

The beginning of the magazine, where articles are small

ATI to nVidia: Gotcha!

We give you the whys and hows of ATI's new GeForce4 killer

The nVidia GeForce line of videocards has been on top for so long, it's damn near the Michael Schumacher of the 3D acceleration race. But not even nVidia can stay in the lead forever. The fruits of ATI's new six-month development schedule are just about ready for public release, and the company's R300 chip should dominate nVidia's finest silicon for at least a few months.

ATI's R300 sports about 107 million transistors on a 0.15-micron process. But aside from its massive transistor count, the most noteworthy thing about the chip is its deep level of programmability. The chip's pixel and vertex pipes are both fully programmable and boast floating-point precision throughout (all other current chips are limited to integer calculations in portions of their pipelines).

The R300—the world's first fully DirectX 9–compatible graphics processor—will make its debut appearance in the Radeon 9700. The card supports memory configs up to 256MB, but will initially ship in a 128MB DDR config. The board we snagged for Dream Machine 2002 (see page 24) ran a 325MHz core and 310MHz memory, neither of which are final clock speeds. Final pricing for the Radeon 9700 hadn't been determined as of press time, but we expect the pricing will be competitive with GeForce4 Ti 4600 cards.

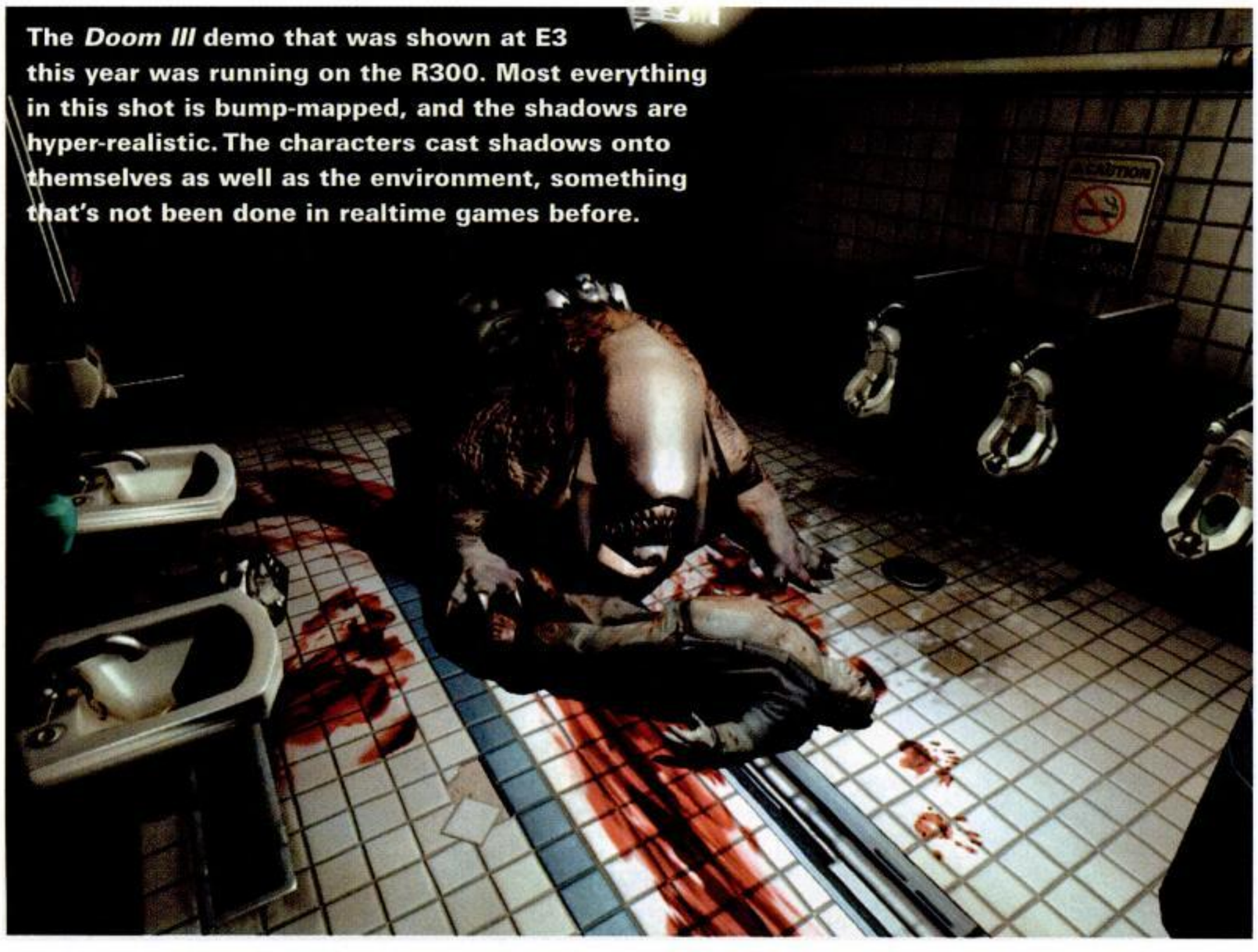
Let's Get with the Program

While DirectX 8 cracked open the door for programmable-shader technology, DirectX 9 will blast the door clean off. The differences between the two APIs are significant and will help the gaming industry reach *Toy Story*–quality graphics that much sooner.

Let's start with DirectX 8 videocards: They can perform just a few CPU-like actions on pixels and vertices in a 3D scene—simple mathematical functions, such as the addition or subtraction of a few values. This level of programming is welcome, but not fully liberating. The DirectX 9 spec, however, demands that videocards be able to digest a full breadth of CPU-like programming: loops, calls, and all the other functions that application programmers have always taken for granted. The upshot is that game developers will finally be able to code any visual effect they can dream up, and games of the future won't look like they're all drawn from the same library of canned effects.

In addition to supporting loops and calls, DirectX 9–compatible chips like the R300 must be able to support floating-point precision through their entire pixel and vertex pipelines. In lay terms, this means that instead of rounding calculations out to the nearest whole number, the R300 and its ilk can output a floating-point number—that is, a number with a decimal point in the middle.

For example, if you divide 7 by 4, the result is 1.75. A videocard that's limited to simple integer calculations will round this up to an even 2, creating imprecision that will confuzzle the rest of the math down the pipeline; as the card continues to multiply and divide, the effects



The *Doom III* demo that was shown at E3 this year was running on the R300. Most everything in this shot is bump-mapped, and the shadows are hyper-realistic. The characters cast shadows onto themselves as well as the environment, something that's not been done in realtime games before.

This ATI demo shows volumetric fur. Pay attention to the wispy hairs around the chin. The color of the hairs also changes as you look at the bear from different angles, just like in the real world!

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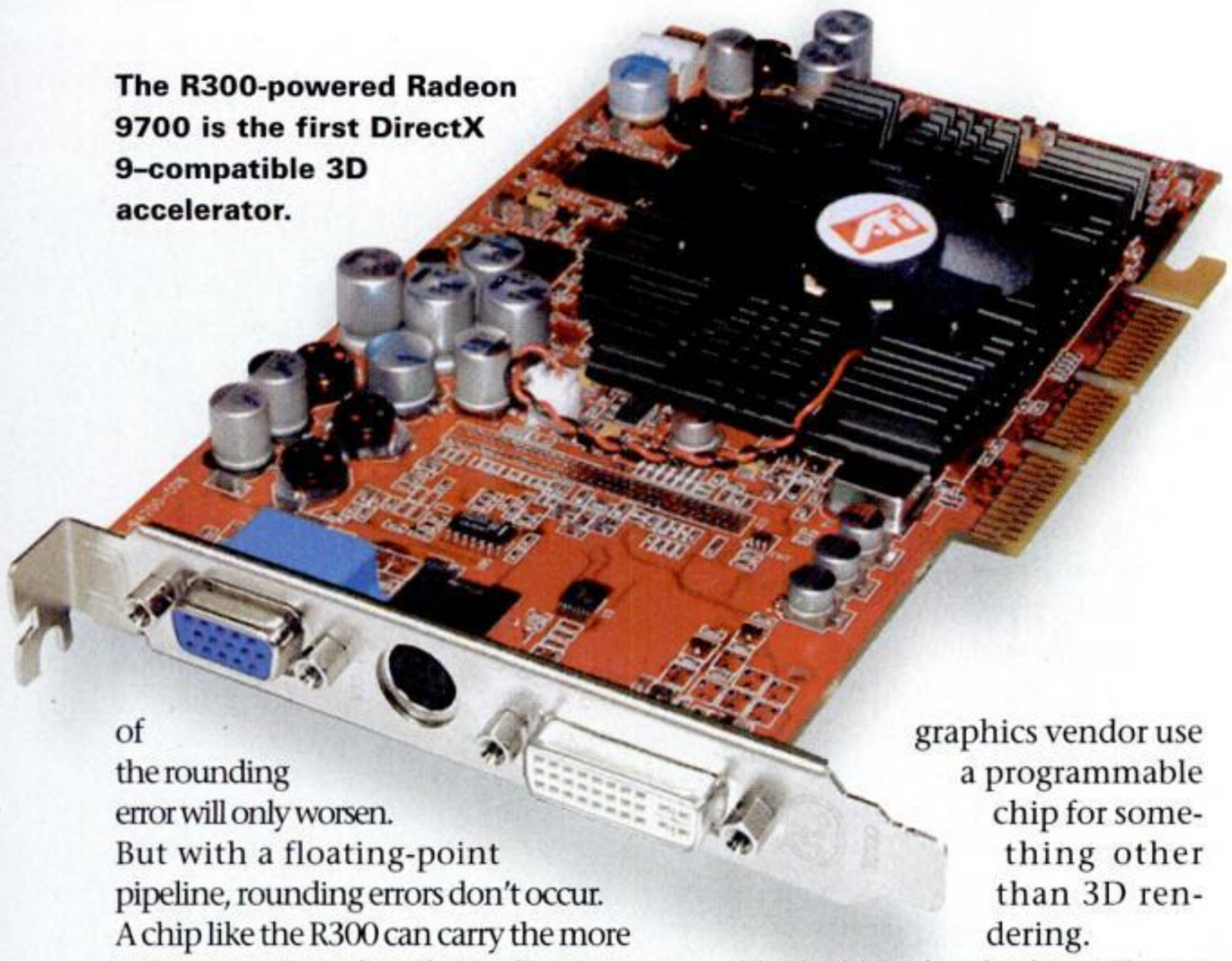

The R300-powered Radeon 9700 is the first DirectX 9–compatible 3D accelerator.

of the rounding error will only worsen. But with a floating-point pipeline, rounding errors don't occur. A chip like the R300 can carry the more accurate 1.75 value throughout its whole pipeline, and developers can focus their attention on *real* problems instead of worrying about how imprecision may cause nasty artifacts.

Intrinsic to DirectX 9 are the new Vertex Shader 2.0 and Pixel Shader 2.0 specs. To comply with these specs, a chip must have full floating-point precision throughout its pipeline, so expect to see this as a standard feature on upcoming cards. Neither the Matrox Parhelia nor the 3Dlabs P10 are fully DirectX 9–compatible, though they both offer full floating-point precision in their vertex pipelines.

Other Goodies

ATI is using the R300's programmable prowess to handle more than just 3D rendering. The company's new Fullstream technology accelerates video regardless of source, and removes unsightly compression artifacts. Interestingly, the Fullstream decoder runs much more efficiently on the R300 than it would on a CPU. This is the first time we've seen any graphics vendor use a programmable chip for something other than 3D rendering.

The R300 is also the first ATI part that uses the more efficient multisampling technique for full-scene anti-aliasing. Previously, all ATI cards used a super-sampling technique, which is very fill-rate intensive and incurs a large performance hit when enabled. To see just how efficient the new AA really is, check out ATI's benchmark scores on page 34.

Finally, the R300 is the first PC product to come from ATI's west coast development team, which designed the chip used in the Nintendo GameCube. Now, with two design teams sharing notes but working on independent projects (the east coast team designed the Radeon 8500's R200 chip), ATI can hit competitive production cycles of six to eight months—just like nVidia.

The R300 is clearly superior to nVidia's GeForce4 Ti 4600, but how long will ATI dominate? NV30—nVidia's next big thing—will probably be on store shelves by the end of this year. Expect it to be fully DirectX 9–compliant, just like the Radeon 9700.

Carmack Speaketh

Here's what John Carmack, id Software's legendary 3D engine programmer, told *Maximum PC* about the ATI R300:

"The R200 already had very good feature specs, providing all the texture units and fragment operations that *Doom III* needs for optimal implementation; it just didn't perform as well as the competitive nVidia cards, due to low-level hardware details. The only new R300 feature that is explicitly coded for is two-sided stencil, which cuts in half the number of stencil shadow triangles that need to be processed, for a worthwhile speedup. The big win is just the raw bandwidth and the eight pixel pipelines, which make the R300 by far the fastest card I have tested for our applications.

"There are a couple minor quality improvements that I would like to try out on the upcoming generation of cards that have more fragment processing capabilities. But that will probably be done through the OpenGL 2.0 rendering path, which won't be available for a while yet."

FAST FORWARD

BY TOM R. HALFHILL

Making a Mountain out of a Yamhill

Intel's rumored 64-bit x86 extensions, known as Yamhill, pose many questions. For instance, why would Intel need another 64-bit CPU architecture? Intel and Hewlett-Packard have already spent the better part of a decade trying to establish IA-64 (Itanium) as the 64-bit successor to the 32-bit x86. Wouldn't Yamhill be redundant?

Answer: Not necessarily. IA-64 isn't taking the world by storm. The first IA-64 processors have been huge, costly, and not exactly speed demons. The next generation (Itanium 2, code-named McKinley) must do better. Yamhill might be a fallback position and a profitable life-extender for the x86.

What if Yamhill isn't software-compatible with AMD's x86-64 extensions? Is there room in the market for two different 64-bit x86 architectures?

Answers: It would be uncharacteristically generous of Intel to design x86 extensions that are compatible with AMD's—and, no, I don't think there's room for mutually incompatible extensions.

As I wrote in the March and June issues, I believe x86-64 is technically sound. AMD also has a head start: The first 64-bit AMD Hammer CPU is promised to ship in a few months, while Yamhill is still at the rumor stage. Microsoft has promised to support x86-64 in a future version of Windows, and a 64-bit Linux is underway.

But if Yamhill comes later and isn't compatible, software developers will have to choose one 64-bit architecture over the other—or support both. The first option isn't likely to work in AMD's favor, given Intel's superior market share. The second option would cause more code bloat (and potentially, more bugs), because the software would have to duplicate lots of code, then check the CPU ID to figure out which 64-bit extensions to use.

We went through this before when Intel and AMD rolled out their mutually incompatible multimedia extensions (MMX, SSE, SSE2, and 3DNow). AMD eventually expanded 3DNow to be largely compatible with Intel's extensions, even though some of AMD's extensions hit the market first. Incompatibility between x86-64 and Yamhill would be worse, because a 64-bit overhaul of a 32-bit CPU architecture is more complex. The extended memory addressing, new registers, and other modifications require more support in the operating systems, not just in the applications.

Whether Yamhill exists or not, the FUD factor is a problem for AMD. And that might be all the reason Intel needs to develop (or hint that it is developing) a 64-bit x86.

Tom Halfhill was formerly a senior editor for Byte *magazine and an analyst for* Microprocessor Report. *He is now a technical writer/analyst in Silicon Valley.*

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You're in the Army Now

Uncle Sam Wants You (to start playing games)!

■ **Lieutenant Colonel Casey Wardynski**

Five days after the debut of *America's Army*—a first-person shooter developed by the U.S. Army and made available for free on the Internet—an astounding 500,000 copies had been downloaded from government servers, and 208,000 virtual enlistees had already completed basic training.

If you're wondering what all the fuss is about, you can find out for yourself at **www.americasarmy.com**. You'll be able to download the missions from there and dive into a gritty, realistic first-person shooter that uses the same engine that will be used in *Unreal Tournament 2003* from Epic Games.

We chatted with Lieutenant Colonel Casey Wardynski, the affable guy behind the idea to use 3D gaming to familiarize a new generation of young 'uns with the armed services.

Q: What are some of the mistakes people make when they start playing *America's Army*?

A: "The easiest way *not* to succeed is to play like an individual, instead of as part of a team. Also, if players don't take advantage of their surroundings, get down low and maneuver, or if they stand up high on a hill or in a window, it's going to be a short game."

Q: Do you lose points for cowering or hiding?

A: "No, you don't. Your score is a team score."

But Lt. Col. Wardynski warned that by this fall, *America's Army* will be implementing a personnel file for each player that will include game statistics and other information, such as your specialization in the field. So if you're a chicken, "you're going to have a hard time trying to find a team that would want you."

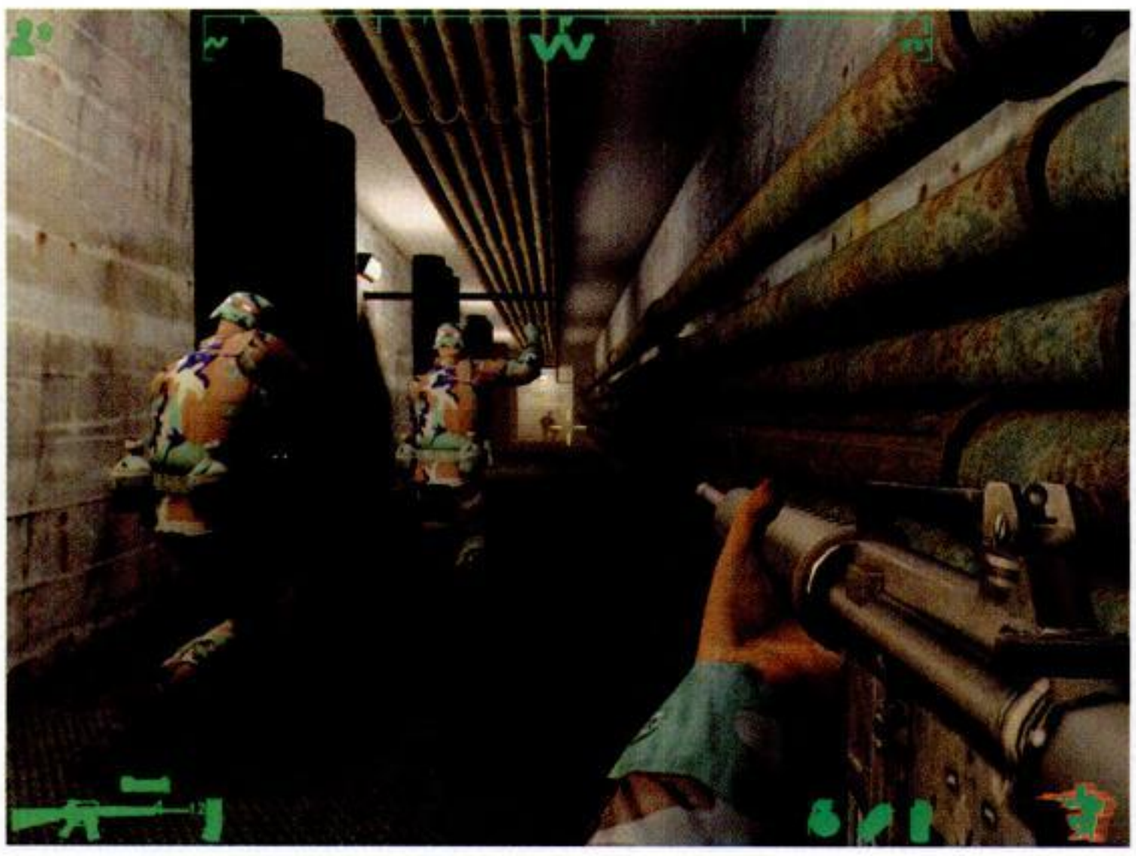
Q: Does the Army believe that skills learned in first-person shooters might directly correlate to battlefield skills?

A: "We're not sure, but we think so. Here at West Point, cadets already use games such as *Delta Force: Land Warrior* and *Steel Beast* in their training. Part of the reason it's successful is that it makes learning fun. It keeps people focused and interested.

"What we hope to do [with *America's Army*] is to prepare individuals for training. If a kid comes into the Army after playing the game, when he goes to the rifle range at Fort Benning, what he saw in the game *is exactly what it's like*. He'll already be familiar with the drills, so he'll be more focused on his training. He'll have more confidence, he'll know what success looks like. That's the training benefit."

Q: Are gays and lesbians allowed in *America's Army*?

A: "The game is very realistic. We don't ask."



■ *The staff of* Maximum PC *appreciates the Army giving away a really cool game. But we're a lot more grateful to the men and women of the armed forces who volunteer their services and risk their lives every day in the defense of our country and our freedoms. Thank you.*

FUN-SIZE NEWS

Texas Firm Claims JPEG Patent

The folks at Forgent Networks—an Austin, Texas–based video networking getup—recently discovered that they owned the patent for JPEG image compression! Patent number 4,698,672, filed in 1986, stakes its claim on "processing signals to remove redundant information."

That certainly *sounds* like JPEG, so much so, in fact, that Sony and at least one other company have already ponied up millions of dollars in licensing fees at Forgent's request. But whether the law agrees with Forgent has yet to be put to the test.

nForce2 Does DDR400, FireWire

Downplaying rumors of an nForce chipset for the Macintosh, nVidia announced a major update to nForce, its Athlon XP core-logic chipset. The nForce2 adds a host of new features, including support for AGP 8x, DDR400, USB 2.0, FireWire, ATA/133, and a GeForce4 MX core. With its new 3D graphics capabilities, nVidia says the nForce2 will easily outperform the integrated graphics parts from Intel, ATI, and VIA.

Perhaps the most surprising feature of the nForce2 is the support for a 166MHz frontside bus. The company says the faster bus is for "overclockers," but we see the increased bus speed from nVidia as an omen that AMD has finally devoted the resources to up the bus speed of its Athlon XP as well.

Silicon? It's for the Birds

One way of creating faster processors is by packing more transistors into smaller and smaller spaces on silicon, a method that may be reaching its physical limit. But the Washington Post reported that Richard Wool of the University of Delaware recently filed a patent that offers a somewhat different solution. Instead of silicon as the basis for microchips, how about chicken feathers?

Here's the idea: Chicken feathers are extremely light and porous, and their high content of air offers very little resistance to electrical signals. So Wool mashed up feathers and plant oils into a prototype composite for testing and discovered that electrical signals traveled twice as fast through this composite as they do in silicon.

Floppy TV

Roll-ups, until now associated with window-shades and fruit snacks, may soon become another form for display devices. Cambridge Display Technology of the UK has developed a process called LEP, or light-emitting polymer, that can display images on a flexible substrate. LEPs generate light when embedded chemical compounds are electrically stimulated, so they don't require any backlighting. The flexible screens have a 180-degree viewing angle, are compatible with current active-matrix TFT (thin-film transistor) drivers, have low voltage requirements, and reportedly don't suffer from the smearing or blurring effects that plague LCDs.

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GAME THEORY

BY THOMAS L. McDONALD

I Was a Teenage Bleeding Heart

I used to be a liberal, but then I grew up. I'm glad I did, because now I can play *America's Army* without fear that Amerikkka's military industrial complex will brainwash me with its insidious (albeit wholly voluntary and torture-free) propaganda, thus continuing its imperialistic tyranny and perpetuating its culture-destroying capitalistic hegemony over the rest of the world.

Whew, it isn't easy squeezing that many empty leftist buzzwords into a single sentence. I don't know how Sontag and Chomsky do it.

Developed by the actual U.S. Army as a PR and recruitment tool, *America's Army* is a first-person tactical shooter built with *Unreal* and freely distributed to anyone who wants it. As a small-L libertarian who thinks the government's responsibilities begin and end with the military, the mint, the coast guard, and interstate highways, this should bother me merely as a needless expenditure of tax dollars. As recruitment and PR campaigns go, however, its $7 million budget is pretty cheap and directly reaches the target audience: young men.

Prior to E3, no one had heard of *America's Army*. After E3, no one would shut up about it. The game inspired a constellation of opinions, but I'll trivialize their points by jamming them into one of two camps. Camp 1 simply said, "cool, free game," and went on their merry way. Camp 2 did a slow burn, shifted uncomfortably in their Birkenstocks, and launched into nauseating anti-American rants, hitting on some (and occasionally all) of the points I listed in the first paragraph of this column. The message: The Army is Evil.

Normally that kind of thing irritates me, but this time I found it *hilarious*. The same people (white, college educated, middle-class people—based on gamer demographics) who howl whenever politicians criticize game violence, are now railing against a game because... it might make kids think favorably about the U.S. Army. In this alternate universe, games created by mega-corporations for entertainment purposes *won't* inspire kids to commit violent acts, but games created by a freely elected government *will* inspire them to—gasp! horrors!—defend their fellow citizens. These Naderites hate the very capitalism that brings them their games and latte, but they hate the U.S. military even more.

But it's too late for me. I've already been brainwashed by the Army, albeit at my desk in my air-conditioned house, on my own expensive computer with its high-speed Internet connection and a cold beer close at hand. It wasn't that passé kind of brainwashing, with the electrified nipple clamps and a black bag over my head. But it's the same thing. Really. My "Issues in Global Socialism" professor told me so.

Tom McDonald has been covering games for countless magazines and newspapers for 11 years. He lives in the New Jersey Pine Barrens.

Self-Help or Legalized Network Sabotage?

Representative Howard Berman (D-CA), pictured here looking suspiciously like Barbara Bush, plans to introduce legislation that will permit copyright owners to sabotage peer-to-peer file-sharing networks such as KaZaa, Morpheus, and Gnutella. His proposed bill authorizes "technological self-help measures" that include "interdiction, decoys, redirection, file-blocking, and spoofs."

Essentially, the bill would legalize a laundry list of scurrilous countermeasures that are currently illegal under federal and state laws, including the recently amended Computer Fraud and Abuse Act.

It's probably safe to assume that Berman wants to appease media moguls living in San Fernando Valley and North Hollywood (both areas are in his district), as well as major campaign contributors such as Disney and AOL. Berman stated that "while P2P technology is free to innovate new and more efficient methods of distribution that further exacerbate the piracy problem, copyright owners are not equally free to craft technological responses."

Although Berman insisted that "a copyright owner should not be allowed to damage the property of a P2P file trader" (by infecting another PC with a virus, for example), his legislation doesn't address specific limits that might prevent a vigilante from flooding a network with bogus files in what might effectively result in a denial-of-service attack.

You can read the full text of Rep. Berman's speech to Congress at **www.house.gov/berman**.

The Mobilphile—— Toshiba's iPod Killer!

We thought the iPod was really cool—for a while. But Toshiba's Mobilphile is going to put a whole new spin on hard-disk based MP3 players. The Mobilphile (we don't know where the "e" in "mobile" went) has roughly the same dimensions as the iPod and comes in foxy metallic trim. But instead of having a built-in hard drive, the Mobilphile uses a removable 5GB PC Card drive. So you can pop out the drive from the main unit, trundle it over to your PC or laptop—anything with a Type II PC card slot—and load it up with files. The Mobilphile supports the playback of MP3, WMA, and WAV files and will store data just like any other hard drive. You'll be transferring files via USB 2.0 at a zesty 480Mbps (if you've got a USB 2.0 card, of course—*go get one*). And naturally, the connection is backwards-compatible with USB 1.1, if you're the patient type.

But what's really clever about the drive is that it could be upgraded to 10GB, or 20GB, or maybe a few petabytes, sooner or later. 1,000 songs. 2,000 songs. Three unique bitrate versions of everything Prince ever recorded *ever*, right there in your pocket where he'd most like it to be. Toshiba hasn't confirmed what drive sizes above 5GB the Mobilphile will support, or if it's firmware-upgradeable. We'll have the details next month.

We still think the iPod is OK, and the really important thing is that the Mac folks got an MP3 player, too.

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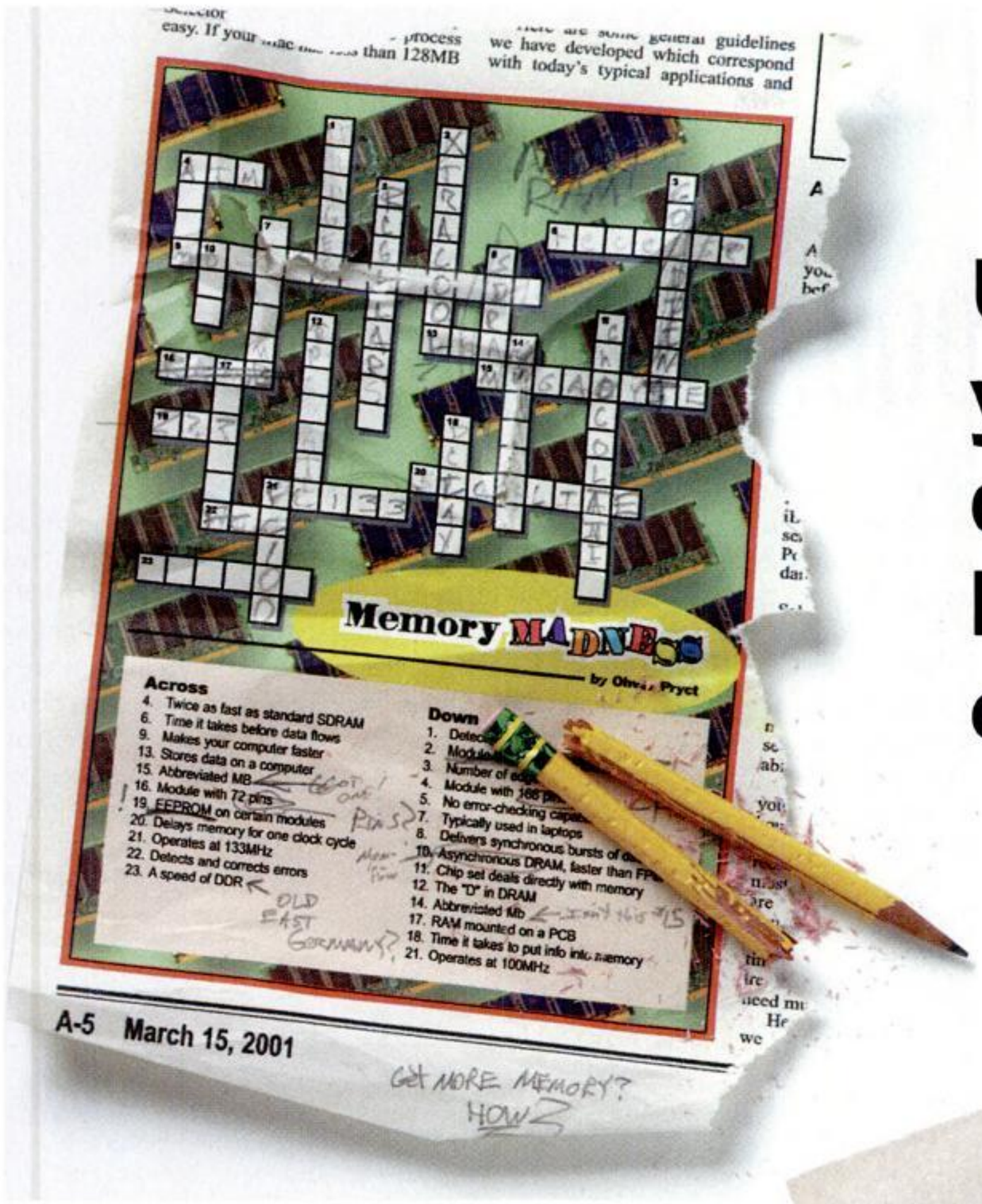
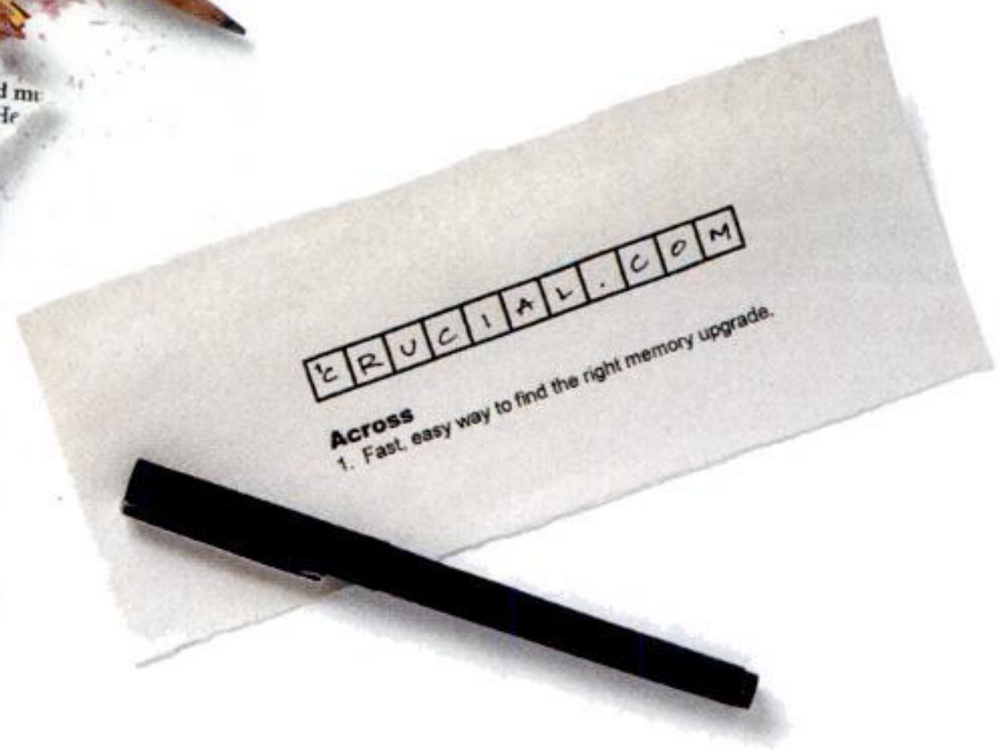

Memory MADNESS
by Oliver Pryct
Across
4. Twice as fast as standard SDRAM
6. Time it takes before data flows
9. Makes your computer faster
13. Stores data on a computer
15. Abbreviated MB
16. Module with 72 pins
19. EEPROM on certain modules
20. Delays memory for one clock cycle
21. Operates at 133MHz
22. Detects and corrects errors
23. A speed of DDR
Down
1. Detec
2. Module
3. Number of
4. Module with 168
5. No error-checking
7. Typically used in laptops
8. Delivers synchronous bursts of
10. Asynchronous DRAM, faster than FP
11. Chip set deals directly with memory
12. The "D" in DRAM
14. Abbreviated Mb
17. RAM mounted on a PCB
18. Time it takes to put info into memory
21. Operates at 100MHz
A-5 March 15, 2001
GET MORE MEMORY?
HOW?



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Head2Head

A showdown among natural competitors

THIS MONTH: Notebook Graphics

After years of ignoring the 3D gaming needs of road warriors, the computer industry has finally gotten serious about pixel-pumping notebooks. In fact, some of today's gaming notebooks—like the Alienware Area 51-M—can put even many desktop machines to shame.

The graphics battle on the notebook front is similar to the battle on the desktop front: ATI and nVidia are sniping each other in a bitter tit for tat. Unfortunately, testing notebook chips is a lot more difficult than testing add-in videocards: You just can't configure a single baseline system, then install each of the competitors at will. So we looked for two notebooks that were as similar as possible with the sole exception of their graphics chips.

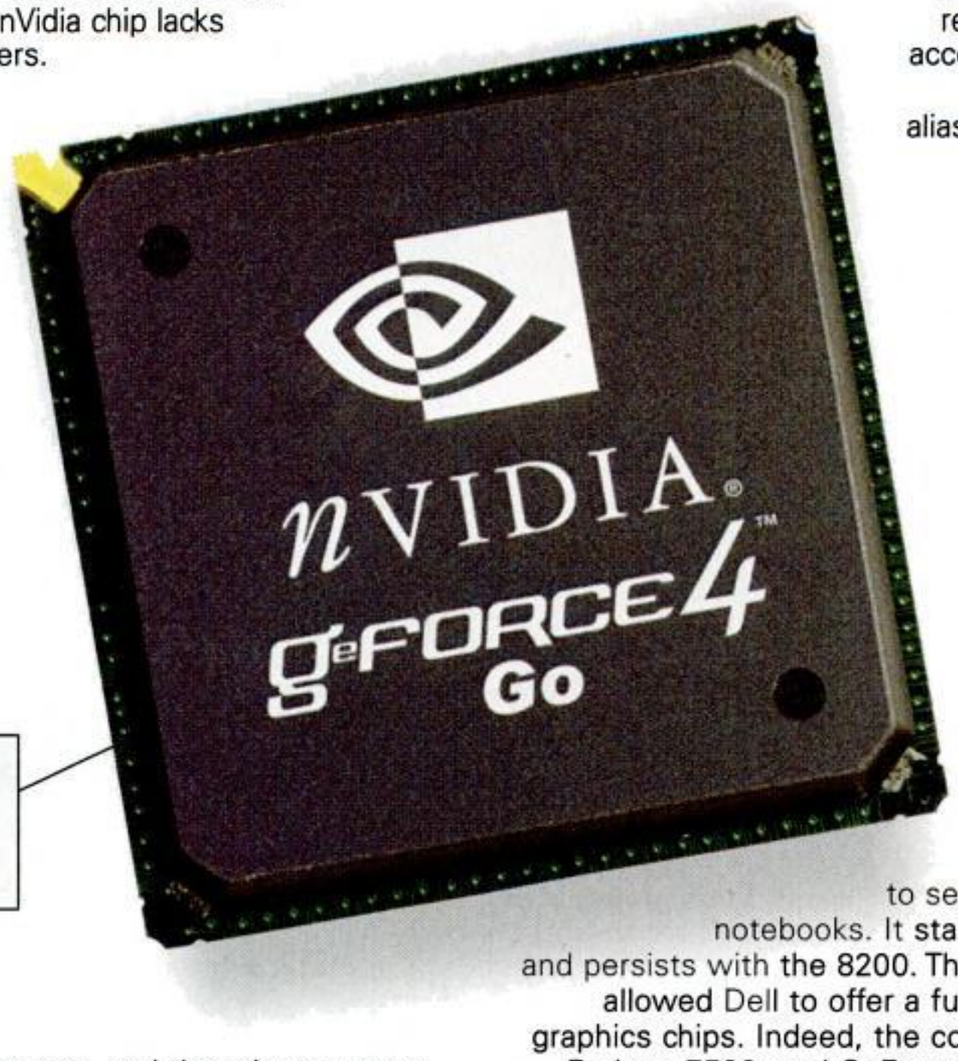
Our Compaq Presario 2800 sports the **ATI Mobility Radeon 7500**, while our Dell Inspiron 8200 comes correct with the **nVidia GeForce4 440 Go**. Both notebooks are configured with 1.7GHz P4Ms, 256MB of DDR266 memory, the Intel 845MP chipset, and Windows XP Home. Unfortunately, we still can't say we've perfectly isolated the respective video chips, because differences in cooling subsystems and even motherboard layouts can affect the performance of either contender. So, in this head-to-head, you also have to factor in the notebook vendor. Consider this a tag-team bout between Dell/nVidia and Compaq/ATI.

—GORDON MAH UNG

NVIDIA GEFORCE4 440 GO

Specsmanship: With 29 million transistors on a 0.15-micron process, the GeForce4 440 Go we tested boasts the highest clock specs of the 4Go family—220MHz for the core and 225MHz for the 128-bit DDR memory. While the GeForce4 440 Go has the edge in memory frequency, the ATI's faster core more or less balances the see-saw. And like the ATI part, the nVidia chip lacks hardware acceleration of programmable shaders. **Winner: Tie**

Market momentum: ATI might control the notebook graphics market, but nVidia certainly hasn't been a piker. Buoyed by the strength of the GeForce and nVidia names, the company has gone from a zero-presence, nonentity to owning 16 percent of the notebook market with just two generations of parts—the GeForce2 Go and now the GeForce4 Go. Still, you can't argue with ATI's 65 percent. **Winner: ATI**



nVidia's GeForce4 440 Go is the undisputed champ in mobile performance.

Performance: This is the most important category, and the winner comes as no surprise. With higher performance in both OpenGL/Carmack games and Direct3D titles, nVidia's GeForce4 Go reigns supreme. The ATI chip wasn't totally annihilated, as updated drivers pushed the Mobility Radeon 7500 within striking distance of the GeForce4 Go in Direct3D. Too bad the latest Compaq drivers also led to *slower* performance in *Jedi Outcast*. Yikes! No matter how you cut it, the GeForce4 440 Go is the faster part. **Winner: nVidia**

Visual quality: Running identical Sony CRT displays side-by-side, we compared the GeForce4 440 Go and Mobility Radeon 7500 with both anti-aliasing and anisotropic filtering turned on and off. Could any of us tell a difference between the two chips' output? No. Both parts exhibited excellent rendering quality. Sadly, neither part could reach acceptable 60fps frame rates with AA enabled, so we're disappointed to see nVidia touting anti-aliased gaming as the reason to buy the GeForce4 440 Go. **Winner: Tie**

Name: We knew what the GeForce2 Go meant—the power of a GeForce2, but "to go." So what does "GeForce4 Go" mean? Our guess is more or less the same thing: a GeForce4 graphics part that's packaged for take-out. Still, we can't help but wonder if the "4 Go" stands for "forgo," as in, "This chip *forgoes* programmable shaders." That's right, the GeForce4 Go is essentially a GeForce4 MX. Regardless, this is the naming battle, not the performance battle, and we have to admit that the name Radeon sounds more plausible and less giggle-worthy than GeForce. **Winner: ATI**

The host body: It doesn't take a genius to see that we're in a love affair with Dell Inspiron notebooks. It started with the 8000, continued with the 8100, and persists with the 8200. The 8 series may be heavy, but the chassis has allowed Dell to offer a full complement of features, including the best graphics chips. Indeed, the company integrated the GeForce2 Go, Mobility Radeon 7500, and GeForce4 440 Go as soon as each chip launched. The Inspiron 8200 offers all the features of the Compaq notebook and adds two PC Card slots, FireWire, a 60GB hard drive, trackpad and stick controllers, one of the best LCD screens around, and healthy battery life when packing two cells. The Inspiron is such a workhorse, it can even pull duties for LAN party gaming. Our love affair was seriously tested by the Compaq's efficient performance-to-size ratio, but there's no denying that the Inspiron is a better desktop replacement. **Winner: Dell**

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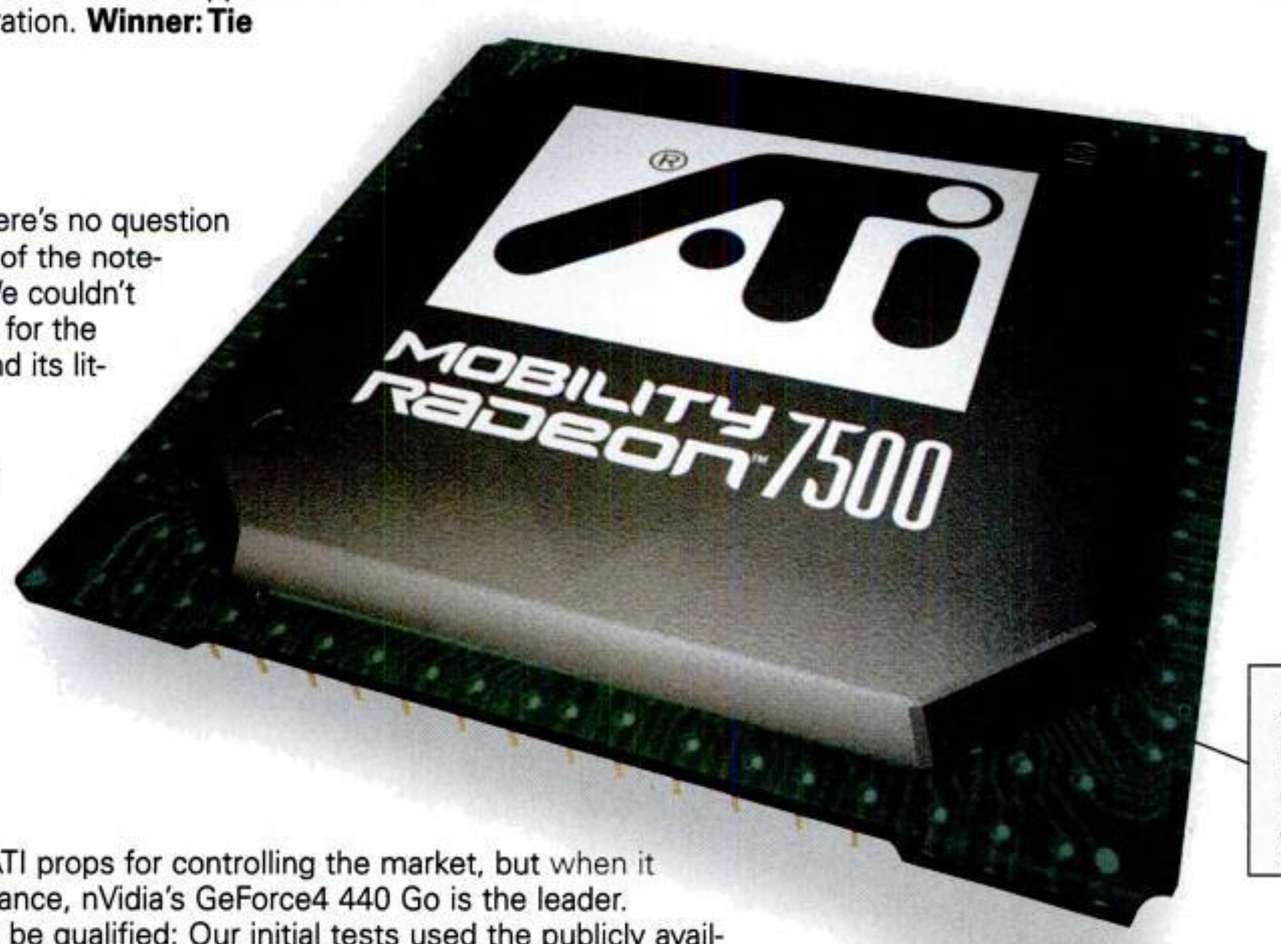
ATI MOBILITY RADEON 7500

Specsmanship: The Mobility Radeon 7500 packs 30 million transistors on a 0.15-micron process and supports both 64-bit and 128-bit DDR SDRAM. Although ATI says you can safely run the core clock at 270MHz and the memory at 183MHz DDR, Compaq opted for a more conservative 260MHz core and 175MHz DDR. When it comes to core speed, the Mobility Radeon 7500 leads the GeForce4 440 Go. But with its memory trimmed down to 175MHz in the Compaq, the ATI chip essentially runs even with its nVidia foe. Programmable shader support? Not until ATI's next product generation. **Winner: Tie**

Market momentum: There's no question that ATI has firm control of the notebook graphics market. We couldn't get precise sales figures for the Mobility Radeon 7500 and its little brother the Mobility Radeon, but Mercury Research reports that 65 percent of the notebooks sold in the first quarter of this year bore the ATI logo. **Winner: ATI**



Performance: We give ATI props for controlling the market, but when it comes to sheer performance, nVidia's GeForce4 440 Go is the leader. However, that lead must be qualified: Our initial tests used the publicly available drivers from Dell and Compaq for each respective notebook—and the Dell/nVidia combo won easily. We then retested the Compaq with ATI drivers that should be publicly available by the time you read this. Did the Mobility Radeon 7500 close the gap? Yes. Did it emerge victorious? Not a chance.

With updated drivers, the ATI chip bounced back in *3DMark2001 Special Edition*, and even its *Quake III Arena* scores improved. But then the Mobility Radeon 7500 ran into the buzzsaw better known as *Jedi Outcast*. Obviously, something is amiss in the OpenGL side of ATI's software. The upshot is that the GeForce4 440 Go is faster, and ATI needs to go back to the driver drawing board—again. That said, ATI officials like to point out that Mobility Radeon 7500 was on store shelves almost six months before nVidia's part. Nonetheless, until ATI releases a mobile version of its awesome Radeon 9700, the nVidia chip is the winner by a healthy margin. **Winner: nVidia**

Visual quality: Visual quality was a serious issue in the days of the nVidia Riva 128 and ATI Rage Pro, but today you'd be hard-pressed to distinguish any differences in how the current chips and their drivers render 3D games. We gave each accelerator a hard look with anti-aliasing and anisotropic filtering both enabled and disabled, and in the end, the rendering output was so similar, it'd be unfair to call the visual-quality competition anything but a tie. But we would like to point out that *neither* graphics subsystem is capable of running realistic frame rates with AA enabled. **Winner: Tie**

Name: Legend has it that ATI originally planned to name its new graphics chip "Radium" after the radioactive isotope. But then the company learned that when the word is translated into certain Asian languages, it becomes, uh, something much less appropriate. So an ATI employee's mom came up with the name Radeon, which sounded similar and didn't offend anyone—except the people working at nVidia. But who can argue with mom? **Winner: ATI**

ATI's Mobility Radeon 7500 is almost a year old, but still offers good performance—if you have the right drivers.

The host body: This is the first time we've played with Compaq's sporty new Presario 2800, and we have to admit, it's damned sexy. About a half-inch thinner than Dell's workhorse, the Compaq is also 2.3 pounds lighter, yet packs onboard Ethernet, a modem, infrared, and a combo drive, and can also accept a Wi-Fi or Bluetooth module. It's also probably the most powerful notebook of its size. Yes, Apple's titanium G4 PowerBook is sexier, but the fruit company doesn't offer the 64MB version of the Mobility Radeon 7500, and its CPU is clocked in the 800MHz range—and that's just oh-so-1999. The Presario 2800 doesn't offer the expandability of the Inspiron 8200, but its thin outline and light weight make up for a lack of add-in bays. Unfortunately, when it comes to all-out performance, the Dell wins, in large part due to its faster graphics and 5400rpm hard drive (the Compaq's drive spins at 4200rpm). **Winner: Dell**

BATTLE OF THE BENCHIES

	Driver Rev	Quake III MPC Demo 1280x1024	Quake III MPC Demo 1280x1024 AA on	3DMark2001 SE Default	3DMark2001 SE 2X AA	3DMark2001 SE 1600x1200	Jedi Outcast MPC Demo 1024x768	Jedi Outcast MPC Demo 1280x1024	Jedi Outcast MPC Demo 1600x1200
nVidia GeForce4 Go	28.35	**68.6fps**	**35.9fps**	**5,024**	2,822	**2,894**	**49.1fps**	**46.1fps**	**34.7fps**
ATI Mobility Radeon 7500	6.13.10.6045	37.0fps	13.6fps	4,387	2,668	2,671	47.2fps	35.6fps	25.7
ATI Mobility Radeon 7500*	6.13.10.6076	55.1fps	27.8fps	4,862	**2,842**	2,795	22.4fps	12.7fps	13.4fps

■ *Tested with a soon-to-be-released update of the ATI driver (which should be publicly available by the time you read this). Winners are bolded.*

THE UPSHOT

Short and sweet: The GeForce4 440 Go throws power punches while the Mobility Radeon 7500 just manages glancing blows. Neither chip can digest programmable shaders, but expect major changes in the mobile graphics market—if not an ATI victory—in the coming months.

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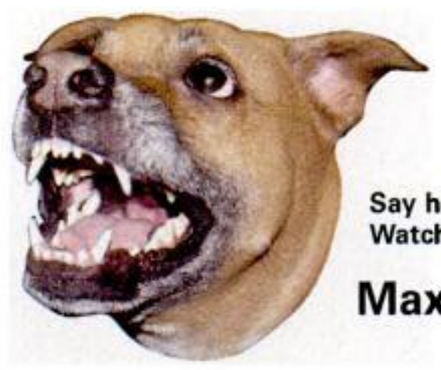
WatchDog



Say hello to **Mattie**, WatchDog of the Month.

Maximum PC takes a bite out of bad gear

THIS MONTH: The WatchDog goes after...

> IBM > Windows XP > Free-iRewards.com

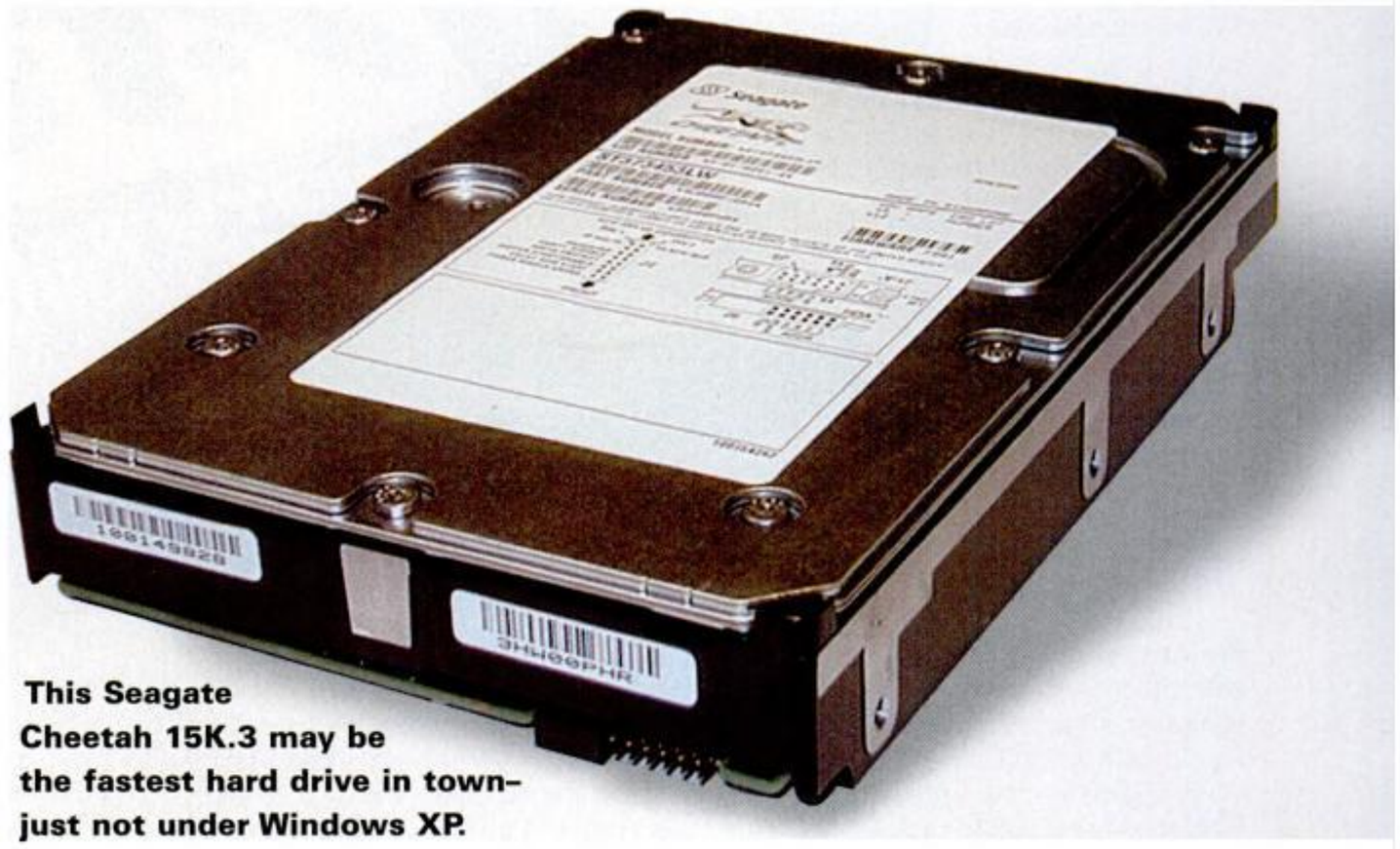
IBM Suit Spreads to Other States

After a setback by a judge, attorneys representing consumers who claim that IBM's 75GXP hard drives are defective have filed suit in seven additional states. In addition to a suit in California, similar suits have been filed in Connecticut, Florida, Illinois, Michigan, New York, Ohio, and Pennsylvania. The move by attorneys Sheller, Ludwidg & Badey on behalf of pissed-off hard drive owners came in response to a California judge's earlier ruling that the state of California has no obligation to protect consumers in other states. The Alameda County Superior Court judge, however, did not rule that the suit was without merit and let it stand on behalf of Californians who own the 75GXP hard drives. The original suit alleges that IBM's 75GXP has a problem with crashing. Although anecdotal complaints to The WatchDog seem to support the suit's allegations, IBM maintains that the drive's failure rate is no higher than the industry standard. More information on the lawsuits can be obtained at www.sheller.com/ibmclassaction.htm.

The problem isn't Seagate's new wonder drive—it's an incompatibility between Windows XP Professional and certain disk-intensive applications.

SCSI Slowdown

Your hard drive performance may be slower than you'd expect if you're running Windows XP Professional or Home with a SCSI rig. That's what users of high-priced and supposedly high-performance SCSI equipment are apparently finding as they convert to Windows XP Pro or Home from Windows 2000 or 98. In fact, *Maximum PC*'s own crew ran into the XP/SCSI bug this month when they first laid down the configuration for the Dream Machine (see page 24). Instead of the nice-but-not-so-exotic ATA RAID configuration that ended up in this year's dream rig, the original configuration included a new hot-to-trot Seagate Cheetah 15K.3 drive. Packing 73.4GB of storage capacity, 3.6ms seek times, and a 15,000 spindle speed, the Cheetah may well be the fastest hard drive around and can even motor past an ATA RAID configuration without breaking a sweat. Indeed, using the quick-and-dirty ATTO hard drive benchmark under Windows 2000 Professional, the Cheetah 15K.3 can't be beat by anything in read or write speeds. Run the drive with Windows XP Professional, however, and the Cheetah 15K.3 is outperformed by a 5400rpm budget drive in write speeds of small files. The problem isn't Seagate's new wonder drive—it's an incompatibility between Windows XP Professional and certain disk-intensive applications.



This Seagate Cheetah 15K.3 may be the fastest hard drive in town–just not under Windows XP.

Only at hard drive fetish web sites such as Storagereview.com has the problem begun boiling over as forum members search for solutions. A previous NTFS fix doesn't solve the problem, nor does the upcoming Service Pack 1. But don't start selling your equipment on eBay, just yet. The Dog has learned from Microsoft that a fix is on the way.

Jeff Goldner, a development manager for the Windows-based group, told The Dog that a combination of long-term goofs led to the SCSI slowdown.

"We share some blame here," Goldner said "[with previous OS versions], we told developers to set FILE_FLAG_WRITE_THROUGH and FILE_FLAG_NO_BUFFERING to obtain better performance." Unfortunately, these instructions don't jibe with Windows XP.

Goldner said the problem actually existed under Windows 2000 too, but many users probably wouldn't have noticed it without turning off write caching. Under Windows XP, the problem manifests because it's assumed by Microsoft that the write through setting is not being used by the application. But because of previous encouragement by Microsoft, many applications that stress the hard drive (such as DV, AV, and benchmark tests) request the flag nonetheless.

"We've done some tests and have seen up to 10x performance hits depending on the packet size," Goldner said. "It depends on the drives and how they implement the cache." Unfortunately, the flag cannot simply be removed from XP because it's absence can affect file integrity. Much of the problem can be addressed by recompiling the applications with the flag turned off or by using XP's compatibility update feature. The updates can fool the applications into thinking the flag is on, while actually switching it off. Goldner said Microsoft expects to release updates within the next three months and will also issue a more detailed Knowledge Base item. Woof.

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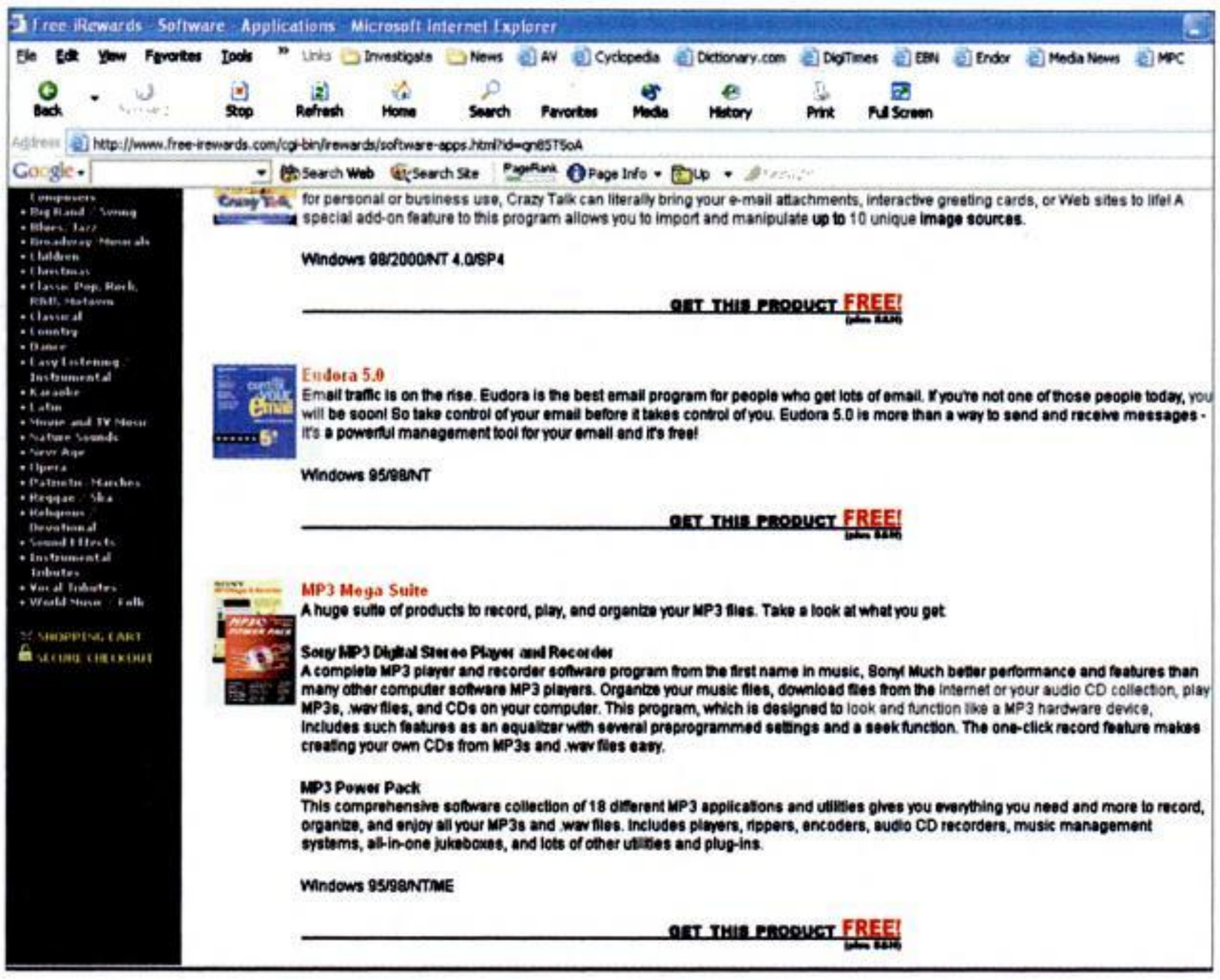
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MP3 Power Pack
This comprehensive software collection of 18 different MP3 applications and utilities gives you everything you need and more to record, organize, and enjoy all your MP3s and .wav files. Includes players, rippers, encoders, audio CD recorders, music management systems, all-in-one jukeboxes, and lots of other utilities and plug-ins.
Windows 95/98/NT/ME
GET THIS PRODUCT FREE!

The ad doesn't mention that the version of *Eudora* you're paying for can be downloaded for free too.

Call It Shipping-and-Handling Ware

DEAR DOG: I recently ordered a copy of *Eudora 5.0* from the web site Free-iRewards.com. The site sells a lot of software for just the cost of shipping and handling. I paid $8.45 for the disc and received just a CD, nothing else. To my dismay, the CD contained only the version of *Eudora 5.0* that's filled with ads. You can download this version for free from the Eudora web site. I contacted Free-iRewards.com and was told that the ad only promised a fully functioning version of the software. Obviously that would keep people from wanting to order it. I am dealing with my credit card company to have this purchase returned and my card credited.

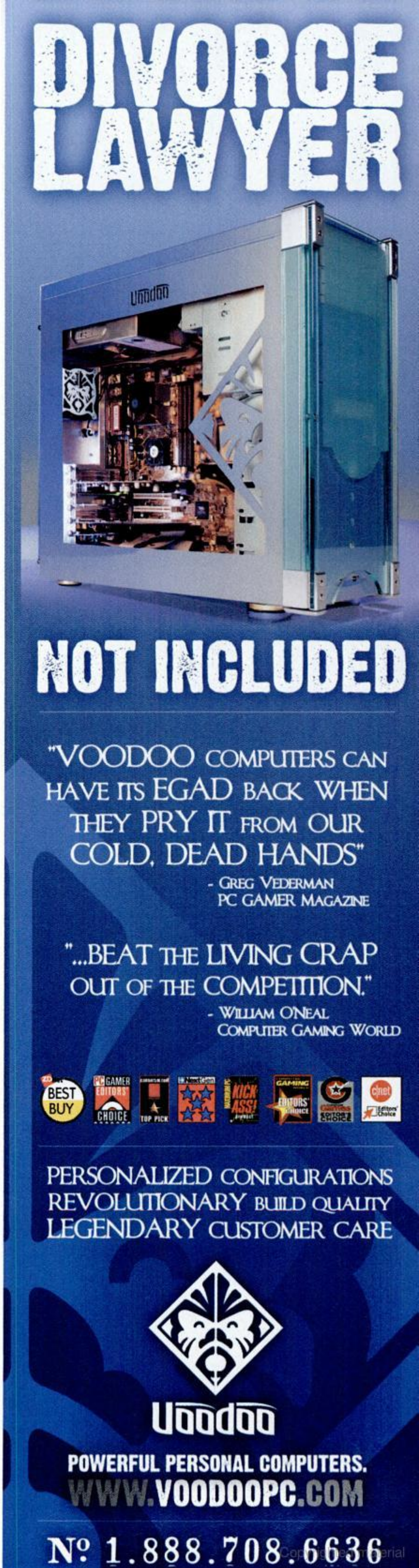
I'm not sure if all the software is this type; I just wanted to let folks know how this company conducts its business and maybe save them some grief.

— DANIEL EMMANUEL

The Dog Responds: The Dog contacted CD Micro of Grants Pass, Oregon, the company that runs the Free-iRewards.com web site, to hear the company's side of the story. A spokesman told The Dog that the company primarily carries full versions of software that consumers can pick up for just the price of shipping and handling. While some versions of the software are current, the majority are older titles. For example, a copy of Intuit's *Quicken 2000 Deluxe* can be had for just $6.95. The Dog must point out, though, that the current version is *Quicken 2002*, and *Quicken 2003* is about to released. The spokesman said the older titles appeal to people who don't need the new features in current versions or who need older applications that will run in Windows 95 or even Windows 3.1. As for the Eudora 5.0 incident, the spokesman said that even though the software can be downloaded for free from Qualcom.com, many of Free-iRewards.com customers don't have a high-speed connection and would prefer to have the app on disc. The spokesman agreed that the information was confusing and apologized, offering to refund Daniel's money. The ad has since been pulled from the web site. Although the original ad should have been more clear, The Dog gives CD Micro props for doing the right thing and responding to a customer's complaint. Woof. ■

"To my dismay, the CD contained only the version of Eudora 5.0 that's filled with ads. You can download this version for free from the Eudora web site."

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic The Dog on them by writing **watchdog@maximumpc.com**. The Dog promises to get to as many letters as possible, but only has four paws to work with.



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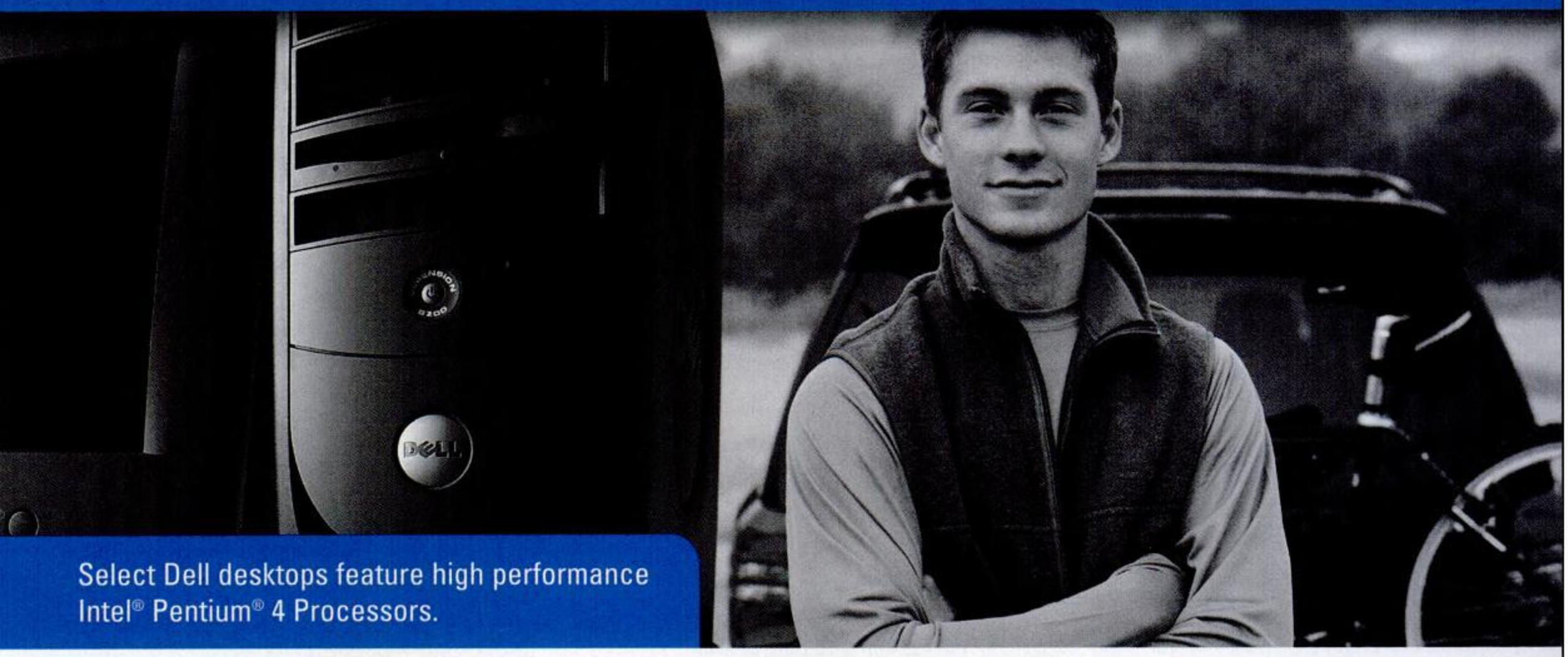

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- 16x Max DVD-ROM Drive
- 40x/10x/40x CD-RW Drive with Roxio's Easy CD Creator® (2nd Bay)
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Each DELL system shown here has a number of standard features, including:

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- Microsoft® Works Suite 2002
- Dell Picture Studio Image Expert Standard Edition
- Dell Jukebox powered by MUSICMATCH®
- 6 Months America Online® Membership Included*
- Dimension Desktops shown here include 1-Yr Limited Warranty,* 1-Yr At-Home Service,* Keyboard and Mouse
- Inspiron Notebooks shown here include 1-Yr Limited Warranty,* 1-Yr Mail-In Service

Dell | Solutions

Software and Peripherals

Desktop:

- Epson® Stylus® C80 Color Printer (Color-Matched to System), $149
- Lexmark™ X83 Multi-Function (Prints, Scans, Copies, and Faxes), $169
- Belkin® SurgeMaster Gold Series Surge Protector, $39
- Canon® PowerShot™ A200, $199

Notebook:

- Tripp-Lite Portable Surge Protector, $20
- Targus® Auto/Air Adapter, $99
- Kensington® SaddleBag, $49
- Kensington® Slim MicroSaver® Security Cable, $37
- Canon® BJC-85 Portable Printer, $299

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- Inspiron 4150 and 8200, $299

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Dream Machine 2002

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Work at Maximum PC *long enough, and you'll eventually become desensitized to the intoxicating allure of the hardware industry's best products.*

Pentium 4s running at 2.5GHz? Snore. GeForce4 Ti 4600s? Whatever.

These pedestrian components no longer impress us. Any podunk system vendor and his brother-in-law "Hank" can ship you a 2.5/Ti 4600 rig these days, and while this combo is indeed powerful, it's just not unique. So when we set out to build Dream Machine 2002—the fastest, bestest, most extreme personal computer of all time—we decided we would have to configure a rig more exotic than a Shanghai breakfast buffet.

We also wanted to design a theme box, a beautifully painted system that would not only pay homage to the exploding case-mod scene, but also celebrate the "PC-as-hot rod" metaphor that Maximum PC *has championed since its inception, exactly five years ago. We ultimately decided to style our own 2002 after one of the most inspiring 2002s ever created—the BMW 2002 Turbo, a limited-run Bavarian wündermobile that leaves car nuts breathless to this day. Just like our 2002, BMW's 2002 shows just how magnificent an "elegant" machine can be when turbocharged under the hood and swathed in aggressive flair.*

For the whole story on our car theme, as well as an explanation on why the hell our front scripting is backwards, *see page 32.* *But if you want to start from the beginning and learn about our ultimate PC part-by-killer-part, then put on your racing helmet and turn the page. Much like an auto show one-off, Dream Machine 2002 is a bespoke proof-of-concept that's been tuned to within just a few degrees of meltdown. It lacks a few amenities, but its speed is unparalleled, and it hints at what system vendors will be moving through their production lines in the months to come.*

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Shopping list

Most of the price quotes below reflect common street prices. In some rare cases, MSRPs have been quoted because street prices haven't yet been established.

2.53GHz Intel Pentium 4	**$600**
Asus P4T533	**$500**
512MB PC1066 RDRAM	**unknown***
ATI Radeon 9700	**$400**
Creative Labs Audigy Gamer	**$50**
Western Digital WD1200JB	**$180**
Western Digital WD1200JB	**$180**
Lite-On 48125W	**$89**
Pioneer DVD-A04	**$250**
Sony F520	**$1,550**
Sharp LL-T1820	**$1,300**
Klipsch 5.1	**$370**
DiskOnKey 512MB	**$500**
Intel Pro/1000MT	**$67**
Microsoft Natural Pro Keyboard	**$75**
Microsoft IntelliMouse Explorer 3.0	**$55**
Cooler Master ATC-110	**$250**
Custom paint and decals	**$800**
PC Power and Cooling Turbo Cool 475-PFC	**$215**
Alpha PAL 8942 heatsink	**$37**
Windows XP Pro	**$260**
Total	**$7,728**

NOTE: An explanation for the unknown price can be found in the section on RAM on the following page.

Case

Cooler Master ATC110

From their fine machined edges to their blue LEDs, the Cooler Masters continue to be the sexiest aluminum cases around. Even better (and this was imperative for Dream Machine 2002), the ATC110 has an aluminum door to hide unsightly drives. The case itself features four fans: a rear exhaust fan, a blow hole, and two filtered 80mm fans to keep your hard drives cool. The entire motherboard tray slides out for easy maintenance.

Cooler Master ATC110

The ATC110 also lent itself well to our ultimate goal: a sporty paint job. Our first instinct, to paint the case ourselves, was immediately scrapped—we're hardware hounds, not industrial artists. We next considered commissioning a local auto-body shop, but figured that even an expert auto painter would burn through at least one or two PC cases before perfecting our custom job. We eventually contracted Falcon Northwest, the high-end gaming PC company. Falcon's PC paint jobs are among the best we've seen, and the company has a lot of experience working with decals (it actually parcels out its custom work to an auto paint shop schooled in the fineries of PC design). After our art director, Natalie Jeday, designed the decals, Falcon's hired guns handled the dirty work: some 9 layers of BMW-correct paint, followed by vinyl stickers, and then six layers of clear coat.

Falcon's charge for our awesome paint job was $800. But, of course, you can't just call Falcon and order a custom-painted case. Normal folk have to buy PCs *inside* the Falcon cases as well.

Power Supply

PC Power & Cooling Turbo-Cool 475-PFC

PC Power & Cooling Turbo-Cool 475-PFC

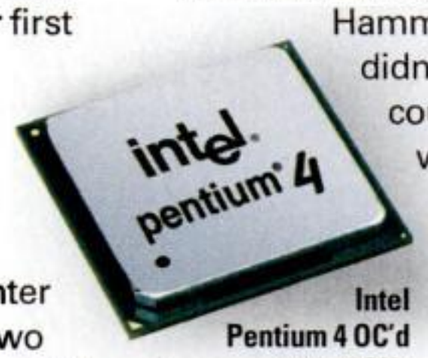
They may look plain-jane, but PC Power and Cooling's power supplies are as solid as big block V-8s. The Turbo-Cool 475-PFC features power-factor correction for more efficient use of electricity and has built-in line conditioning to better handle power sags. We took a stock Turbo Cool 475-PFC—good for 475 watts—and gave it a purty mouth by covering its unsightly power cables with expandable sleeve tubing.

CPU

Intel Pentium 4 OC'd to 2.85GHz

If you've been following the performance vector of the Athlon XP processor, you know that AMD has hit a wall, while Intel has been releasing faster and faster Pentium 4s on a regular, almost blasé basis. So in June, when we were just beginning to requisition parts in earnest for the Dream Machine, we pretty much knew we'd be running the fastest Pentium 4.

Now, it's not as if we didn't try to pull a rabbit out of AMD's hat. Many months ago, we initiated negotiations to secure a Hammer, AMD's next-gen CPU. We didn't know if an early sample could whip the fastest P4, but we thought that Hammer would at least be an eclectic choice, and, after all, AMD had shown off working silicon more than six months ago. Unfortunately, no amount of wheedling, bargaining, or begging could get us any play from AMD, which apparently won't release Hammer for many more months. This left us with an Intel-only box, and we were concerned that at two months old, the P4 2.53GHz was already a little archaic.



Intel Pentium 4 OC'd to 2.85GHz

We were also worried that Intel would release a faster chip just days after we locked down our Dream Machine configuration, and we'd be left with a CPU that was just top-of-the-line as opposed to other-worldly. Thus, we began sweating our Intel contacts for a crack at their next speed grade. We didn't know the frequency, Kenneth, but we did know that the next bin jump would be a helluva lot faster than 2.5GHz, and we wanted the sucker in our fantasy box.

We tried. Trust us, we tried. "What if we trade you a Bobba Fett action figure and two free Big Gulps?" No luck. Intel wouldn't budge.

In the end, we were left with no recourse but to grab Intel's current best and overclock the sucker just a few degrees shy of oblivion. So, we took one of two 2.53GHz P4s humming away in the Lab and started wailing on it. Because production P4s have locked multipliers and can't be unlocked via "body modifications" like Athlon XPs, we resorted to a straight bus overclock. Intel's 0.13-micron Northwood process is renowned for its overclocking prowess, and

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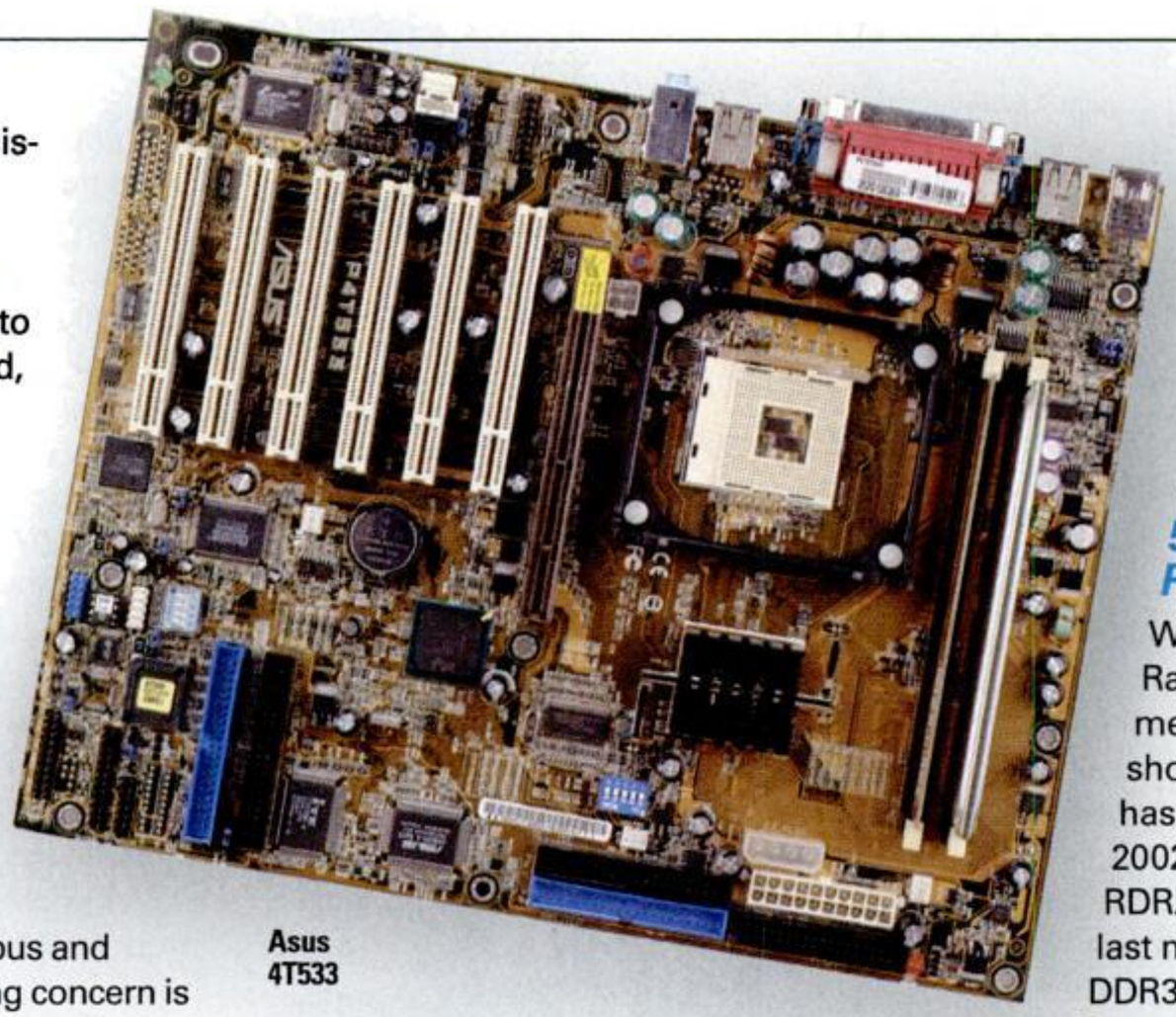
our humble two-fiver didn't disappoint us. By pushing our mobo's bus from its stock 533MHz to 600MHz, we were able to move the 2.53GHz up to a heady 2.85GHz. Overclocked, yes, but DM2002 runs quite stable nonetheless.

In fact, only when we approached 3GHz did the system begin showing signs of rejection. And we don't blame the CPU, because overclocking RDRAM systems can be tricky, and overclocking 1066MHz memory can be even trickier. In the end, we're more than happy with our 600MHz bus and 2.85GHz CPU. Our only nagging concern is that Intel will eclipse DM2002's overclocked CPU frequency by the time you read this.

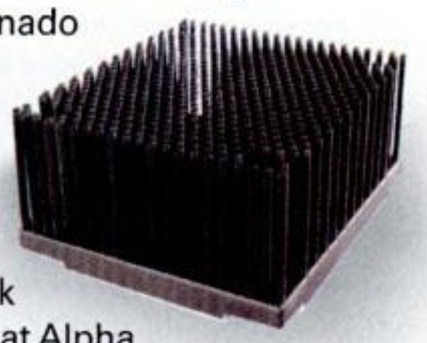


Asus 4T533

CPU Heatsink

Alpha Novatech PAL 8942

Constructed of copper and using hexagonal dissipation shafts, the PAL 8942 is so beefy, you have to mount it directly to your motherboard using Alpha's custom hardware; the stock plastic P4 mount just won't do. The best part of the PAL 8942 may be its flexibility in accepting any 80mm fan. If you like the sound of a Hoover vacuum running in your case, you can mount a high-velocity VantecTornado fan. If you want pretty lights, you can mount Antec's tri-LED 80mm fan. We stuck with the stock 80mm Delta fan that Alpha ships with the PAL 8942, and had no heating problems whatsoever.



Alpha Novatech PAL 8942

Motherboard

Asus P4T533

Like the sound of thunder over the horizon, the words "DDR! DDR! DDR!" have been alerting us to an impending silicon El Nino for months. Would we select DDR333 memory and overclock it to DDR400 levels? No. The Intel platform may be shifting from RDRAM to DDR, but it doesn't mean *Maximum PC* has to shift with it. Not right now, and not for a machine that aspires to be the fastest desktop computer on the planet. So we went with an RDRAM motherboard. You may hate Rambus, Inc.'s guts, but RDRAM memory has proved that it can easily scale to high speeds, while the current iteration of DDR cannot.

With our memory type decided, we next had to pick a motherboard—something that would be ripe for overclocking and also provide enough onboard features to free up a bunch of PCI slots. Well, you can't get much more exclusive than the Asus P4T533.

Don't confuse this board with the P4T533-C, which uses 16-bit RDRAM. The P4T533 uses newfangled 32-bit RDRAM modules. Essentially combining two 16-bit channels into a single 32-bit channel, a RIMM4200 module (the equivalent of PC1066) eliminates the need for matched pairs of memory, a requirement that has confused P4 users since the introduction of the CPU.

The P4T533 uses Intel's 850E chipset, a slightly enhanced version of the original 850 chipset. Six PCI slots are complemented by a 533MHz bus, USB 2.0, and ATA/133 RAID via a soldered-on Promise controller. The mobo also allows you to individually set your AGP and PCI bus speeds so you *don't* overclock your peripherals. We locked down AGP at 67MHz and PCI at 33MHz, then nudged our system bus to 150MHz, all quite effortlessly. With the quad-pumped bus of the NetBurst architecture, that's a smooth 600MHz, for all intents and purposes. Our CPU actually ran stable at stock voltages, but we gave it a 0.05-volt jolt just to keep it awake and aware of who's boss of whom.

RIMM4200 and its baby brother RIMM3200 don't have the blessing of Intel, so we can't tell you where this single-channel, 32-bit technology is going. Sure, it's very possible that next year you'll see "quad-channel" P4 chipsets running two RIMM4200 modules, but there's probably a greater chance that we'll be adding the Asus P4T533 to the Museum of Motherboard Has-Beens. Our mobo may not be the most sensible choice for someone who wants an upgrading foundation for years to come, but building a Dream Machine is all about achieving the fastest performance in the here and now.

RAM

512MB Samsung RIMM4200 module

While some PC enthusiasts hate Rambus, Inc. for barreling through the memory industry like a bull in a china shop, most will concede that RDRAM has proved its worth. In our January 2002 "Speed Issue," we saw PC800 RDRAM blow the doors off DDR266, and last month we saw PC1066 sprint past DDR333 in our "Intel Mobo Melee." So for Dream Machine 2002, we wanted memory bandwidth that would easily

DREAM CLASSICS

A stroll down Dream Machine memory lane can show you just how far we've advanced in five short years.

1998

CPU 400MHz Pentium II OC'd to 450MHz

RAM 128MB PC100 SDRAM

Video 16MB Matrox Mystique G200 and 12MB 3dfx Voodoo2

HD 9GB Seagate Cheetah UW

1999

CPU 500MHz Pentium III*

RAM 128MB PC100 SDRAM

Video 32MB Matrox Millennium G400Max

HD 18.2GB Quantum Fireball Plus KA

2000

CPU Dual 1GHz Pentium IIIs

RAM 512GB PC800 RDRAM

Video 64MB GeForce2 Ultra

HD Two 18GB Seagate X15 Cheetahs, 75GB IBM 75GXP

2001

CPU 1.8GHz Pentium 4 OC'd to 2GHz

RAM 256MB PC800 RDRAM

Video 64MB GeForce3

HD Two 60GB IBM 60GXP in RAID 0

** Our Dream Machine 1999 article focused on building one's own PC, not ultimate performance. A 600MHz P-III processor was actually available at the time.*

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512MB Samsung RIMM4200 module

destroy the plebeian DDR SDRAM and even outpace PC1066 RDRAM. We decided that Rambus's next version of RDRAM—PC1200—was what we had to have.

Because there was no PC1200 actually available, we turned to overclocking a single stick of PC1066 to PC1200 frequencies. As stated above, RIMM4200 modules combine two 16-bit channels into a single 32-bit channel, eliminating the need to run modules in pairs. PC1200 also provides 4.8GB/sec of bandwidth—a nice performance leap over PC1066 (4.2GB/sec) and PC800 (3.2GB/sec). Using the Asus P4T533, we overclocked both the frontside bus of the CPU as well as the memory bus, giving us even data rates between the two.

So can a "mere" 512MB of RAM be considered dream-worthy? We agree that 1GB or 2GB would have been preferred, but overclocking PC1066 RDRAM is a tricky proposition, and attempting to overclock two or four modules to 1200MHz isn't as easy as pushing just a single module to the edge of the abyss. So we were quite sold on the idea of OCing just one module. Even more importantly, our overclocked Radeon 9700 videocard—oops, did we let that leak out?—was most comfortable running in tandem with the 512MB RIMM4200 on the Asus P4T533. In the end, we decided that stability and an overclocked videocard were more important than the few extra *SYSmark2002* points that we *might* have achieved from running 2GB of memory.

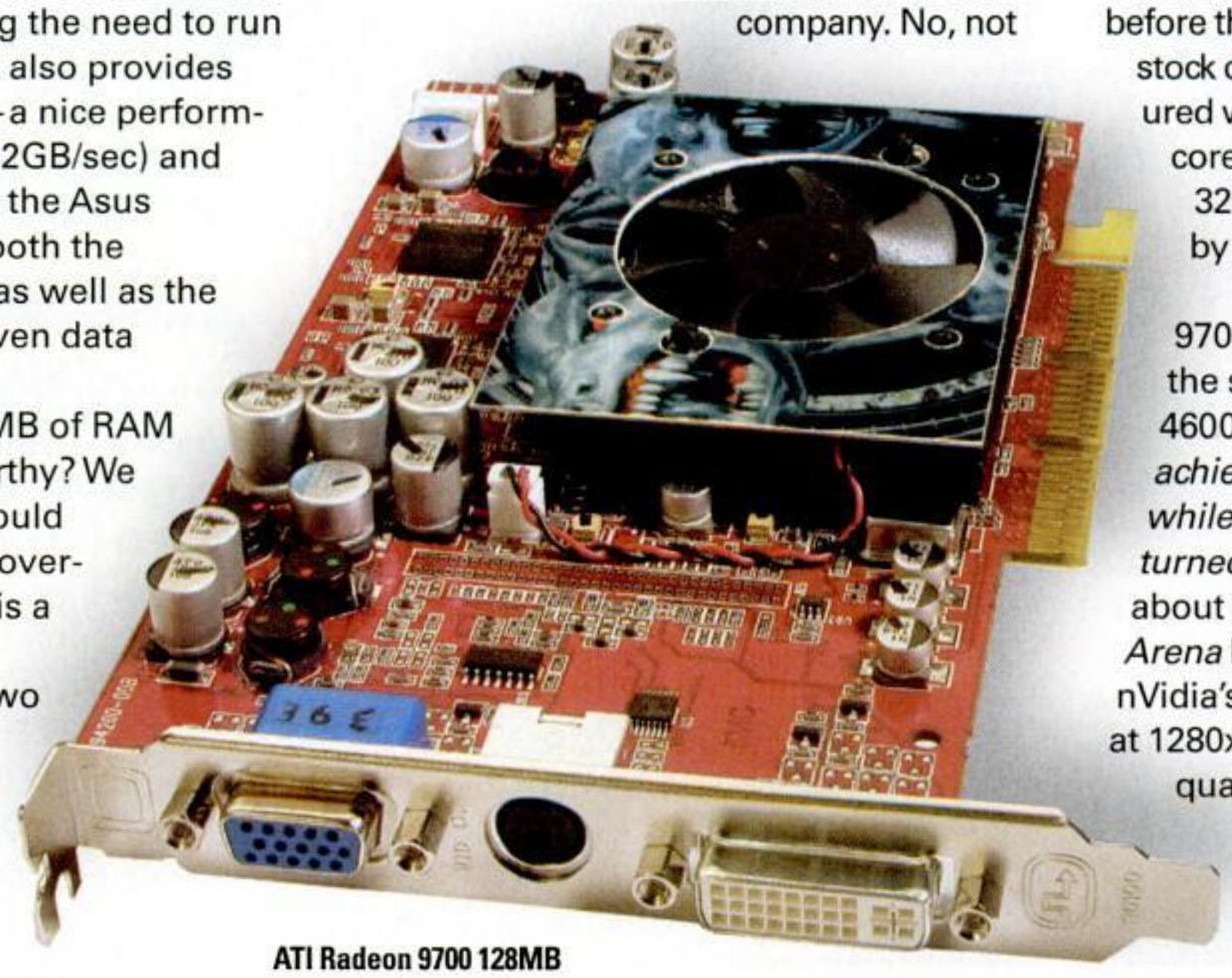
As far as pricing goes, we have no idea how much our memory costs. Because single-channel, 32-bit modules are so rarefied, Asus is shipping its P4T533 motherboard with the memory bundled in. And in fact, Samsung is reportedly having difficulty hitting 1066MHz with its RIMM4200 modules, so Asus will actually be shipping the motherboard with slower RIMM3200 modules, and only 256MB versions of RIMM4200 (which cost $310 when purchased with the mobo). We were lucky enough to receive a fully stable 512MB RIMM4200 module before Asus's plans solidified, thus making Dream Machine 2002 more extraordinary than we had ever planned and the cost of a 512MB RIMM4200 a non-issue for the time being.

Videocard

ATI Radeon 9700 128MB

We knew that if we didn't play our cards right, we'd be stuck with a videocard that even our wretched intern team has had access to for the last six months. Sure, the GeForce4Ti 4600 is fast, but it's just not *interesting*.

Knowing that nVidia's next-gen part was months away, we turned to the other Canadian graphics company. No, not Matrox. ATI. Rumors of the ATI R300 had been riding the Internet winds for months. Was it possible we'd have ATI's next-gen card in time? We broke out our big guns and sent our editor-in-chief on a James Bond–like mission to soften up the company.



ATI Radeon 9700 128MB

Breaking bread at a fancy-pants restaurant, Phillips cut a deal: "We get an early version of the card—beta silicon, beta drivers. If it sucks, we pretend we never saw it and promise not to slam it until the technology is ready for a final review. But if the R300 is as badass as you claim, the card is in and ATI is everyone's hero." ATI agreed.

Having long been the Curly to nVidia's Moe, ATI wanted to do some head-slapping and eye-poking of its own. An ATI product manager, engineer, and PR boss secretly slipped into our office in early July with the R300 (now known as the Radeon 9700). We cleared out nonessential personnel (read: interns) from the area, did a sweep for bugs, and fired up the card. Whoa, mama! The R300 easily destroyed the overclocked GeForce4Ti 4600 that we had prepped as a stand-in should the R300 go limp.

Designed as a fully DirectX 9–compliant part, the Radeon 9700 features eight pipelines, 107 million transistors, and ass loads of memory bandwidth (more can be found on page 12). But because we were dropping the card into Dream Machine 2002, we also wanted an edge over all the "other" Radeon 9700 cards floating around the world (i.e., the ones in ATI's laboratories—because ATI tells us we had our card at least a month before the competition). ATI hadn't yet set its stock clock speeds at press time, so we figured we'd lead the charge by clocking the core to 350MHz and the memory to 325MHz DDR (near-certain overclocks by ATI's own estimation).

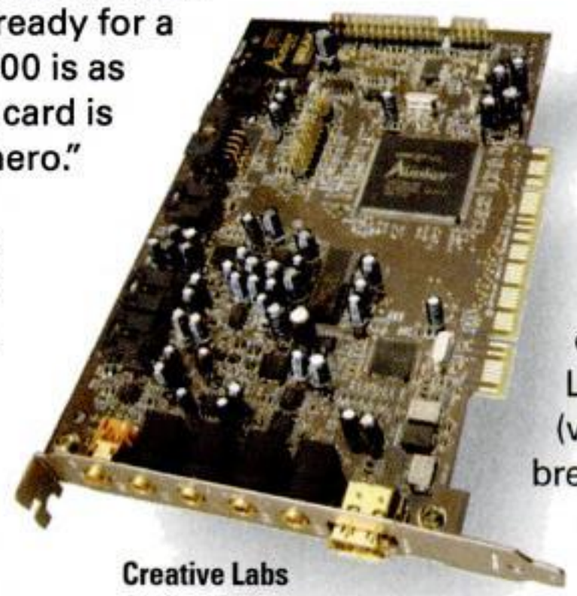
So how fast is it? Well, our Radeon 9700 scored 12,130 3DMarks—about the speed of the average GeForce4Ti 4600. *That nVidia card, however, achieves such scores with AA turned off, while the Radeon 9700 does so with AA turned on.* The Radeon 9700 was also about 110 percent faster in our *Quake III Arena* benchmark, twice the speed of nVidia's best in *3DMark2001 SE's* Game 4 at 1280x1024, and exhibited superb visual quality overall.

Not bad performance from a card that was about a month away from being final.

Soundcard

Creative Labs Audigy Gamer

While we love the Philips' Acoustic Edge (its unique audio character is glorious in gaming), we went with a Creative Labs Audigy for its superior overall sound quality and FireWire jack. With 24-bit audio fidelity, the Audigy is the best consumer-level soundcard for instrument recording, MP3 playback, and DVD home theater, and the FireWire jack can be used to capture video from a DV cam or even to build a fast peer-to-peer network.



Creative Labs Audigy Gamer

You'll notice that we're using the base-level Gamer version of the Audigy instead of the Platinum version (which comes with a front-mounted Live! Drive) or a Platinum Ex (which comes with a Live! Drive breakout box). The extra connectors offered by the Live! Drives are nice, but the front-mounted version

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TURBO-COOL 475 ATX-PFC
TURBO-COOL 475 A4-PFC (Tyan 2462, 2468, more)
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[1] PC WorldBench 4 score running Windows 2000 (higher no. is better).

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SLEEKLINE 2400 (2.4GHz Pentium 4)

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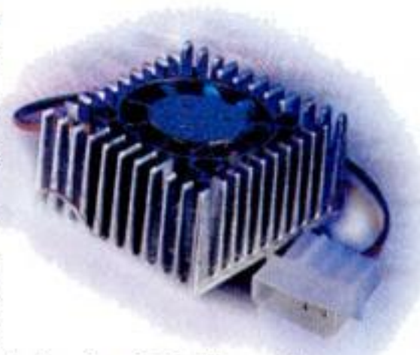

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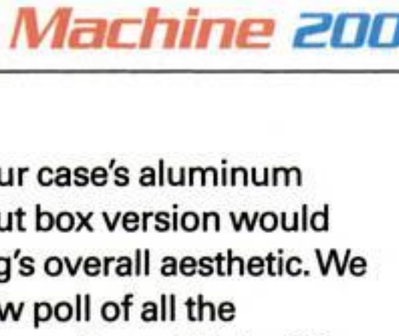
wouldn't fit behind our case's aluminum door, and the breakout box version would just clumsy-up our rig's overall aesthetic. We also took a quick straw poll of all the *Maximum PC* editors, and found that while we dig the extra connections offered by the Live! Drive, no one on staff has ever personally used the ports. Don't underestimate the Gamer—it's identical to the Platinum and Platinum Ex, but just lacks the fancy box.

Hard Drives

Two Western Digital WD1200JBs



Two Western Digital WD1200JBs

At one point early in its lifetime, Dream Machine 2002 was running the single-fastest hard drive in existence: Seagate's 15K.3, which offers the industry-leading combination of a 15,000rpm spindle speed and a 34.1Gb/square inch areal density. During rudimentary benchmarking, we were blown away by the 15K.3's ability to surpass even the fastest ATA RAID setups.

Unfortunately, upon digging deeper, we ran into a bug. It seems that Windows XP will impede the small-file write speeds of any SCSI hard drive setup. (The whole story is explained in this month's WatchDog column.) We tried the beta version of Service Pack 1, and even tapped our contacts at Microsoft, but couldn't get around the glitch. The problem was profound enough to affect our *SYSmark2002* scores, so we went with the next-fastest hard drive setup available: a pair of Western Digital WD1200JB drives running in RAID 0. Each ATA/100 drive holds 120GB, features 8MB of cache, spins at 7200rpm, and is surprisingly quiet. The two drives are controlled by our motherboard's ATA/133 Promise chip, and when striped together, offer 240GB of storage and the fastest data transfers you'll ever find on the IDE bus.

Lite-On 48X

CD-RW Drive

Lite-On 48X

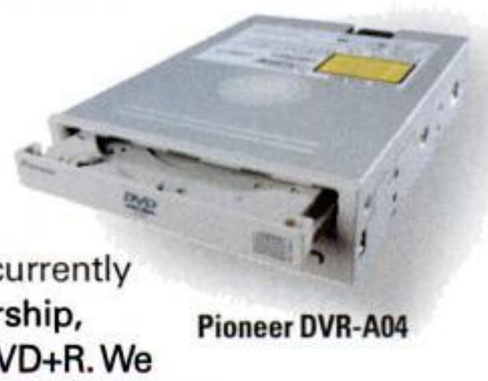
That's right: Lite-On. What's an $8,000 PC doing with an $89 drive, you ask? Uh, just pulling the fastest benchmarks around, that's all.

It's not our fault that Lite-On consistently cranks out the fastest CD burners. We're talking "fast" as in "writing 650MB in two-and-a-half minutes fast." Disc reading hits 20x at the slowest, innermost part of the CD, and ratchets up to over 48x at the outer edge. Access times are among the lowest we've ever seen. We gave a lot of consideration to Yamaha's CRW-F1 (see page 69), but the Lite-On's raw performance beat out the Yamaha's features.

Even when we restricted our ripping speeds to 48x, the Lite-On gave us a top-notch rip. It takes a lot to veer us away from putting Plextor burners in our annual Dream Machines, but we don't think there's a faster drive on the market right now. And did we mention it costs just $89?

DVD Burner

Pioneer DVR-A04



Pioneer DVR-A04

Refresher course: There are two DVD burning specs currently vying for leadership, DVD-RW and DVD+R. We considered putting DVD+RW in Dream Machine 2002 for about three nanoseconds. Not only does "dash" media cost less than "plus" media ($1 vs. $6-to-$7), -RW discs also offer far greater compatibility with set-top DVD players. This means that DVD movies cut on DVD-RW burners are much more likely to play on Grandma's creaky, first-generation DVD player.

So choosing DVD-RW was the natural choice, and that meant using Pioneer's DVR-A04. We did all we could to snag a rumored 4x version of the drive. We even made threats that we'd ditch DVD-RW entirely, and side with DVD+RW. But it appears that Pioneer USA was hamstrung—it regularly gets dissed by Pioneer Japan. DVD burning is still trying to find itself, but there's no question that even 2x "dash" burning is superior to any type of "plus" burning.

CRT Display

Sony F520

For what must be the umpteenth year in a row, Sony's flagship monitor serves as our primary Dream Machine display. We

Sony F520

can't say the repetition is boring, because every minute spent with the F520 is a minute spent with the finest aperture-grille monitor in the land. Key features include: a 2048x1536 resolution at 85Hz, a screen so flat its curvature is truly imperceptible, and (best of all) an industry-leading 0.22mm grille pitch. The skinny pitch renders the finest detail you'll ever see on a desktop, and the monitor's overall brightness and brilliance are simply breathtaking.

Sony says that if it wanted to, it could improve the monitor's scanning capabilities to hit higher refresh rates. But because no users have ever requested higher scan rates, the F520 remains essentially the same. Later this year, its four-port USB hub will convert to USB 2.0, and the monitor will get a new film coating. But for now, the best-looking, most advanced CRT on the planet remains unchanged.

LCD Display

Sharp LL-T1820

Sharp LL-T1820

The display industry may have hit a point of diminishing returns in its CRT development, but LCD development still has a long way to go, which is exactly what makes the LL-T1820 so special. Besides offering world-class screen uniformity and brilliant image-quality overall, the new Sharp displays 1,024 graytones per pixel—an industry first. The jump from 256 to 1,024 graytones makes a tangible difference when viewing high-detail photos, so we'd be remiss if we teamed up the Sony CRT with any other flat-panel LCD.

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Klipsch 5.1

Speakers

Klipsch 5.1

There's not much to say about the Klipsch 5.1s except that you better make sure your neighbors like your style of music. Ideal for a small home-theater setup but equally adept at gaming, the 5.1s are anchored by a freak-nasty subwoofer boasting dual 8-inch drivers. Toss in five two-way satellites, and you have a recipe for ear damage. But these babies aren't just about volume—they also offer crisp, clean sound reproduction regardless of how loud you play them. They've been the best for so long, we're *almost* beginning to take them for granted.

"Floppy Drive"

512MB DiskOnKey

512MB DiskOnKey

Every time we configure a Dream Machine without a floppy drive, readers complain. So this year, we did include a "floppy" drive—but it's the floppy drive of the future. M-System's DiskOnKey is just as portable as a wee floppy, but can tote a whopping 512MB, all in a little widget that you can wear around your neck. The nubbin is fully plug-and-play compatible, and doesn't need drivers under modern Windows OSes.

NIC

Intel's Pro/1000 MT

Intel's Pro/1000 MT

It's hard to find overkill in an Ethernet card, but we found just that in Intel's Pro/1000 MT. Along with support for Ethernet and Fast Ethernet, this NIC supports Gigabit Ethernet, which beats Fast Ethernet by a cool 900Mbps. We doubt many people are running gigabit switches in their homes, but it's nice to know that Dream Machine 2002 is ready to roll at 1Gbps should we ever attend a LAN party where all speed limits are essentially lifted.

A Tale of Two 2002s

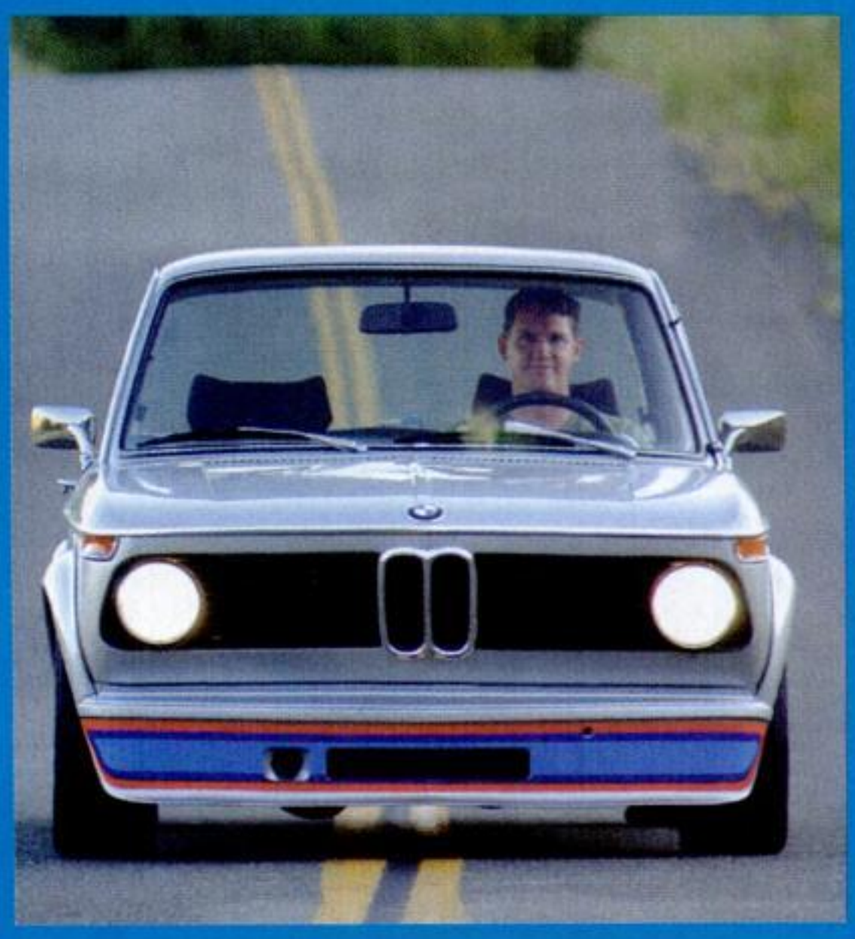
THE 2002 TURBO wouldn't have been able to beat an American muscle car in a drag race, but if driven with proper care for its explosive power delivery, the grippy German four-banger would almost surely provide better traction and faster exit speeds on twisty mountain roads. Hence the reverse "2002 Turbo" scripting on the early models' front air dams. The words were meant to intimidate slower drivers who saw the car looming large in their rear-view mirrors. Rumor has it that public outcry forced BMW to ditch the "aggressive" lettering, and the car you see on this page lacks the in-your-face nuance.

An estimated 1,672 Turbos were produced between 1973 and 1975. The car was a limited-run version of the marquee-defining 2002, and was actually the first Euro production car to come with a turbocharger.

Its unique styling is defined by a deep front air damn, a trunk spoiler, flared wheel-well extensions (dig the rivets), and irresistible motorsport striping. Under the hood was a 1990cc in-line four given the breath of life by a Kuhnle, Kopp & Kausch turbocharger. Max horsepower and torque was rated at 170bhp and 177lb/ft, respectively. Zero-to-60 required a quaint 6.9 seconds. This isn't very quick by today's standards, but you have to consider that even a modern Subaru WRX is quicker than some of the Ferraris and Maseratis sold in the 1970s. One could argue all day about which car might serve as the best inspiration for Dream Machine 2002. But in the end, we just couldn't resist picking a turbocharged car that was already named 2002.

Below left: We wanted all the other machines in the Lab to know just which badass PC was coming up from behind them.

Below: Sean Casey and his immaculate Turbo live just a half-hour north of the *Maximum PC* offices. We were able to locate only two other running examples in the United States: one in Nevada, and the other in Maryland.



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Natural Keyboard Pro and Microsoft IntelliMouse Explorer 3.0

Mouse & Keyboard

Microsoft IntelliMouse Explorer 3.0 & Natural Keyboard Pro

Let's face it: It's hard to get excited about mice and keyboards, especially when our overall machine is so damn over-the-top. So above all else, we wanted input devices that would just stay the hell out of our way while enjoying Dream Machine 2002's awesome power. Microsoft's IntelliMouse Explorer 3.0 is simply the best mouse in the house. It samples 6,000 times a second with its updated optical sensor, requires no cleaning, and seems to work on any surface. The Natural Keyboard Pro, meanwhile, is similar to the original Natural, but also gives you USB and programmable keys.

OS

Windows XP Professional

It's a monopoly. Get over it. WinXP Pro was the only OS even considered for Dream Machine 2002. BeOS, Linux, OS/2, and CP/M had no chance because we wanted to play current games, run the latest applications, and work with drivers that we didn't have to write and compile ourselves.

Windows XP Professional

Above: We had Falcon Northwest do a perfect color match of BMW's original Polaris Silver paint. Our motorsport stripes are also 100 percent Pantone correct.

Left: For the full story on how Falcon painted the case, air-brushed its fine details, and cut out its decals, look for our special newsstand-only *Ultimate PC How-To Guide* in mid-October.

Dream Machine 2002

Five benchmark records—shattered!

This year's Dream Machine isn't just the fastest PC we've ever built, it's also the fastest we've ever test ed. And it's not just the fastest we've ever tested, it's also faster than we ever expected. But, hey, we're not rocket scientists. We're just privy to rocket-fast parts. Overclock the world's fastest CPU, toss in experimental RDRAM, and top it off with next season's videocard, and you've got benchmarks that can't be beat.

To put Dream Machine 2002's power in perspective, consider the "ultimate gaming PC" built by a competing web site. They posted their config—a 2.5GHz P4, 512MB PC800, a GeForce4Ti 4600—just as we were screwing down the last bolt on our "best PC ever." In *3DMark2001 SE,* their seemingly formidable machine hit 11,388 3DMarks. We, meanwhile, hit 12,130—with *4x AA turned on.* Running the default *3DMark2001 SE* benchmark (with AA turned off) pushed the Dream Machine to 15,853 3DMarks, the most we've ever seen.

It's important to remember that *3DMark2001 SE* is weighted toward DirectX 7 gaming. The Radeon 9700's architecture is tuned for DirectX 9 gaming, and you really can't see the card's full potential unless you're running games with programmable shaders. To wit, the card kicked much ass in *3DMark2001 SE* Game 4, which makes heavy use of pixel and vertex shaders. At 1280x1024 with AA turned off, our Dream Machine was *100 percent faster* when running the Radeon 9700 than when running the overclocked GeForce4Ti 4600 that we were using as an understudy. And with 4x AA turned on at the same resolution, the GeForce4 chugged along at 15.8fps, while the Radeon 9700 was pushing an amazing 41.5fps.

Jedi Outcast, an OpenGL game, demonstrated the Radeon 9700's ability to render anti-aliasing without flinching. With 4x AA turned on, Dream Machine 2002 hit 72.4fps in our home-brewed *Jedi Outcast* benchmark—exactly the same score that it achieved when running with AA turned off. Meanwhile, the nVidia card's *Jedi Outcast* scores plummeted from 72fps to 55.6fps when AA was flipped on.

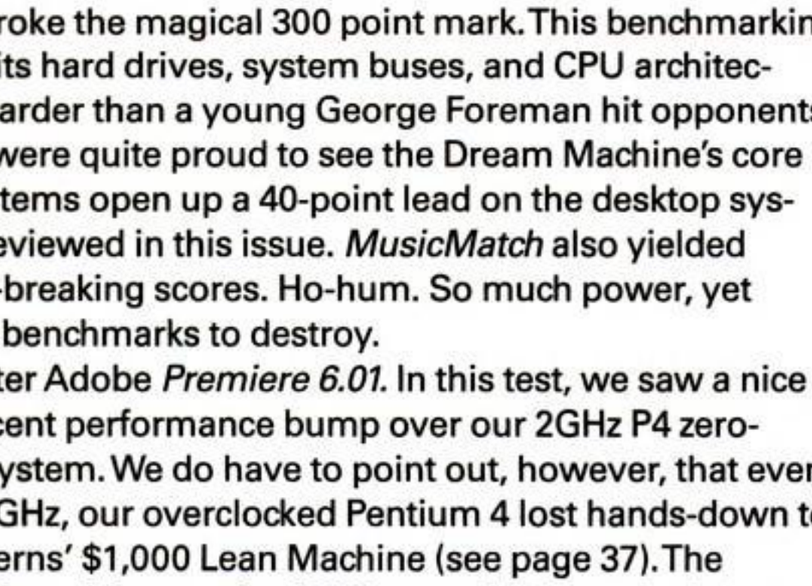
Quake III Arena testing sealed the Ti 4600's coffin. At 1280x1024, the overclocked Ti 4600 hit 133.9fps; the Radeon 9700 hit 148.8fps. And with 4x AA turned on, the Ti 4600 dropped to 55.7fps, while the Radeon 9700 maintained a "more-speed-than-you'll-ever-need" 117fps. Keep in mind that all these scores were pulled from the same Dream Machine 2002 testing platform. It's a good thing we were able to swap the nVidia card for the ATI card at the eleventh hour.

In SYSmark2002 application testing, Dream Machine 2002 broke the magical 300 point mark. This benchmarking suite hits hard drives, system buses, and CPU architectures harder than a young George Foreman hit opponents, so we were quite proud to see the Dream Machine's core subsystems open up a 40-point lead on the desktop systems reviewed in this issue. *MusicMatch* also yielded record-breaking scores. Ho-hum. So much power, yet so few benchmarks to destroy.

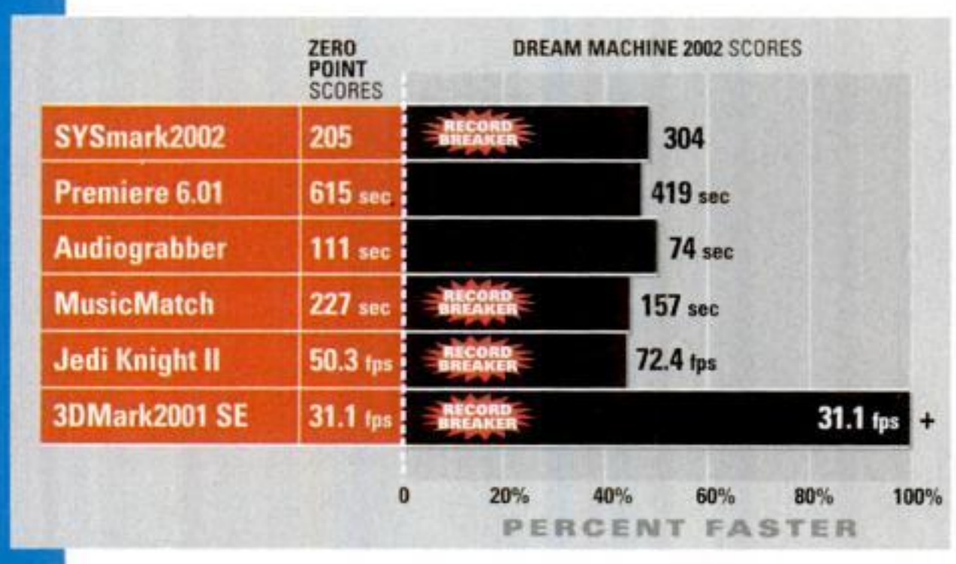
Enter Adobe *Premiere 6.01.* In this test, we saw a nice 46 percent performance bump over our 2GHz P4 zero-point system. We do have to point out, however, that even at 2.85GHz, our overclocked Pentium 4 lost hands-down to our interns' $1,000 Lean Machine (see page 37). The interns' machine required 362 seconds to manipulate an MPEG2 video clip, while Dream Machine 2002 needed 419 seconds. It's no secret that the Athlon XP kicks Intel butt in apps that don't take well to the P4's architecture, and *Premiere 6.01* is just one of those programs. Hats off to AMD, and hats off to our interns.

In September 2000, we predicted that CPUs would be pushing 2GHz by September 2001, and we were correct. This year, just shy of 3GHz, we're going to predict that next year's best Intel rigs will push 4GHz (on a 0.09-micron process) and system buses will hit 667MHz. Of course, we can't count out AMD's upcoming Hammer CPU, which is expected to debut in excess of 2GHz sometime in early 2003.

We can't predict which companies will be on top by next September, but we can promise that you'll see the fastest components in Dream Machine 2003, by hell or high water. See you next year!



Who let the dogs out?: We have no idea what the "dogs of war" silkscreen on ATI's cooling apparatus is supposed to signify, but our WatchDog gives it a hearty woof!



Our zero-point system includes: an Intel D850MV motherboard, a 2GHz P4 CPU, 512MB PC800 RDRAM, a GeForce4 Ti 4600 videocard, and a Western Digital 1000BB hard drive (2MB cache).

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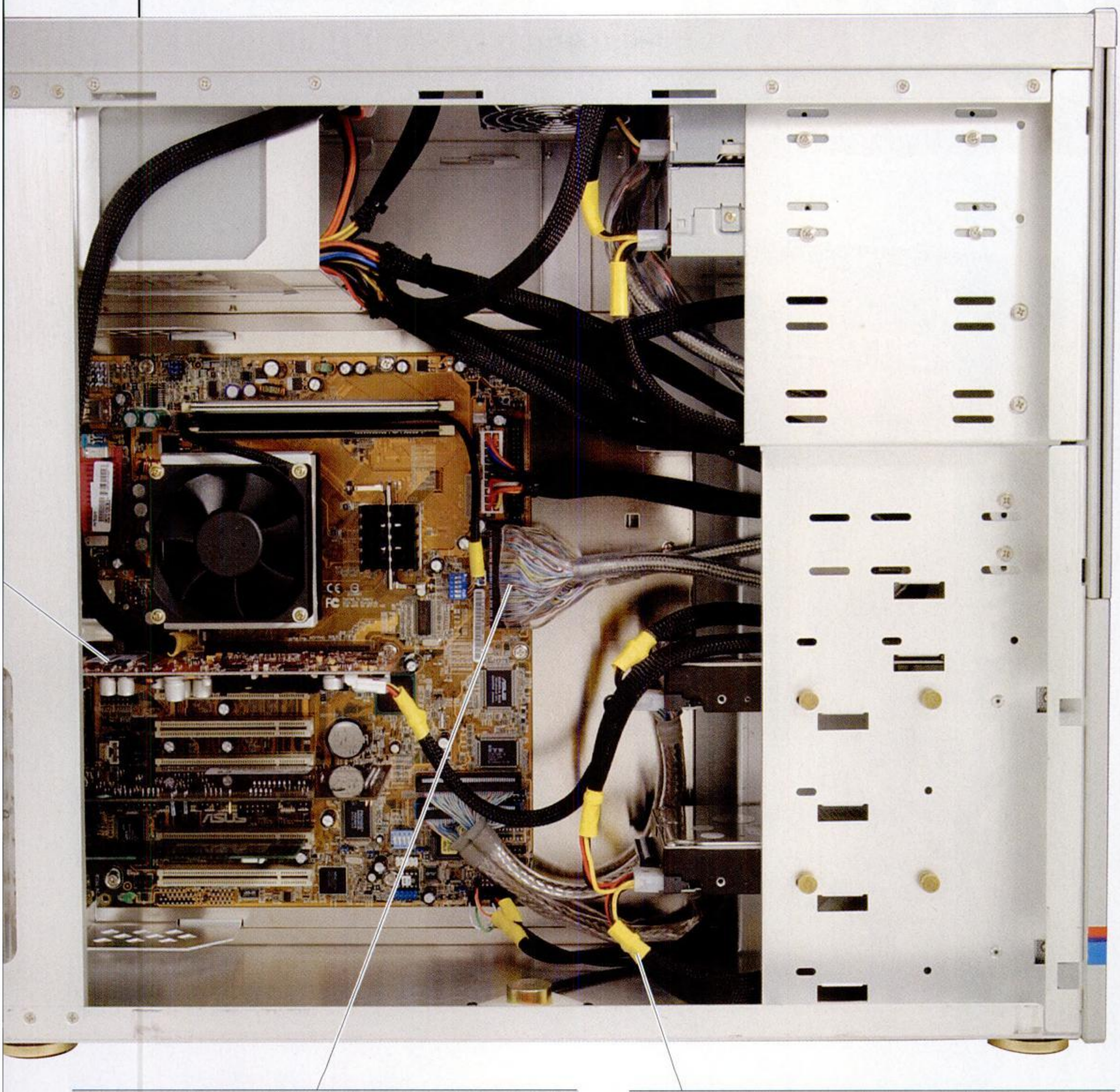
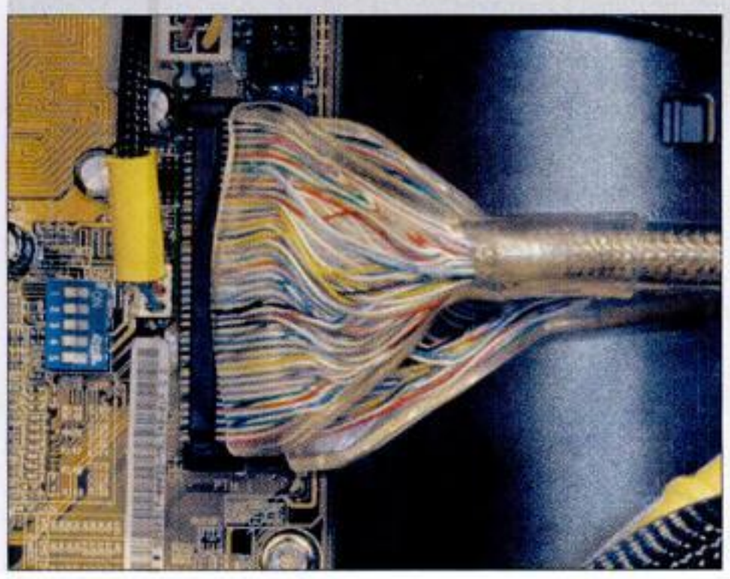
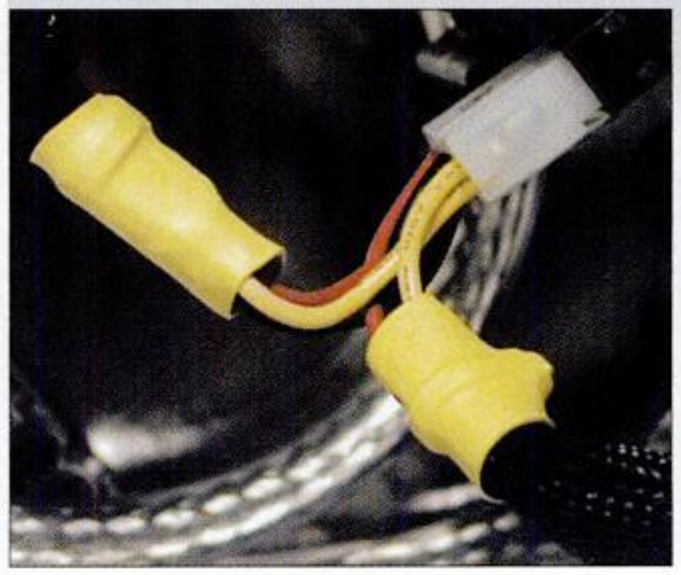




Clear coats: We used clear, rounded IDE cables because they beautify the case interior and increase its air flow. The cables' braided hosing also makes the interior look a bit more like a hot rod engine bay.



Black ropes: We custom-fitted all other interior cables with flexible tubing, heat-shrink tubing, and wire ties. The cabling looks good, keeps the case interior tidy, and improves airflow.

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Lean Machine 2002

How three scrappy interns configured the world's best $1,000 PC

Maximum PC's Summer Intern Team includes (left to right) Brian Lam, Johnathan McKinney, and Omeed Chandra.

Even geeks can be bullies. With a cold glare in their eyes, the Maximum PC Council of Elders gave the intern team just two weeks and a measly G to build Lean Machine 2002—the budget alternative to the hot rod featured on page 24. We knew it was a setup. They were planning on kicking silicon in our faces.

With $1,000, the editors were probably expecting us to slap together a mere play toy, a mouse for their Pentium 4–driven panther to swat around. But with geek pride on the line, we weren't going down without a fight (or at least some serious hair-pulling and sissy screaming). With experience, industry connections, and an unlimited budget, the editors had us severely outgunned, but we interns weren't without our advantages: youth, boyish good looks, ingenuity, a disregard for conventional clock speeds, and the fact that there's never been a better time to build a smoking machine on the cheap.

A thousand bucks leaves no room for top-end circuitry, hard drive RAID arrays, or custom paint jobs. Indeed, she isn't pretty, but she's got a lot more under the hood than anyone ever expected. What we built isn't the fastest machine you'll ever benchmark, but it's sure to keep the editors up at night, wondering why they spent mountains of cash on the Dream Machine when our Lean Machine manages to do so much for little.

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Behold the Ingenuity!

Or... "How to Squeeze Every Drop of Performance from Budget Silicon"

In all their benevolence, the editors didn't force us to squeeze a monitor, speaker set, mouse, and keyboard under our $1,000 limbo stick. But here's what we did include in our precision-engineered rig:

▸ **CPU** 1.67GHz Athlon XP (OEM version). It falls way short of industry-leading performance, but nothing in the Pentium 4 stable can keep up for the low, low price of $130.

▸ **MOTHERBOARD** Asus A7V333. Stable as your shrink's shrink, the AV7333 comes with support for DDR333 memory, RAID, USB 2.0, and FireWire. Bus settings from 100MHz to 225MHz, adjustable CPU voltages from 1.75 to 1.85, and thermal protection make overclocking easy.

▸ **MEMORY** 512MB of Corsair CAS2 PC2700 DDR. For the speeds we were aiming for, PC3000 DDR would've been overkill. So we went with low-latency PC2700 (DDR333), but from a top manufacturer to ensure overclocking headroom.

▸ **VIDEOCARD** Gainward GeForce4 PowerPack! Ultra/650XP Golden Sample. An overclocker's dream, this Ti 4200–based accelerator is Lean Machine material through and through. It's got speed, a low price, and a really ugly name.

▸ **HARD DRIVE** 80GB Western Digital 800JB. Basically, it's the same kick-ass hard drive as those used in the Dream Machine. It's got an 8MB cache, but is 40GB smaller (and isn't doubled up in a RAID array).

▸ **OPTICAL DRIVES** Pioneer DVD-116 and Lite-On 32/12/40 CD-RW. The Pioneer handles DVD playback for the cost of a couple DVD movies. Meanwhile, the 32x Lite-On CDRW is nearly half the price of the 48x version found in the Dream Machine, but offers much, much more than half the performance.

▸ **SOUNDCARD** The OEM version of Creative Lab's Sound Blaster Audigy boasts all the famous Sound Blaster compatibility and features, but lacks the premium price, Live! Drive I/O bay, remote control, and the annoying Creative Labs software.

▸ **NIC** 3COM 3c905b. We chose it for its strong driver support, but, truthfully, any old card would have done us right.

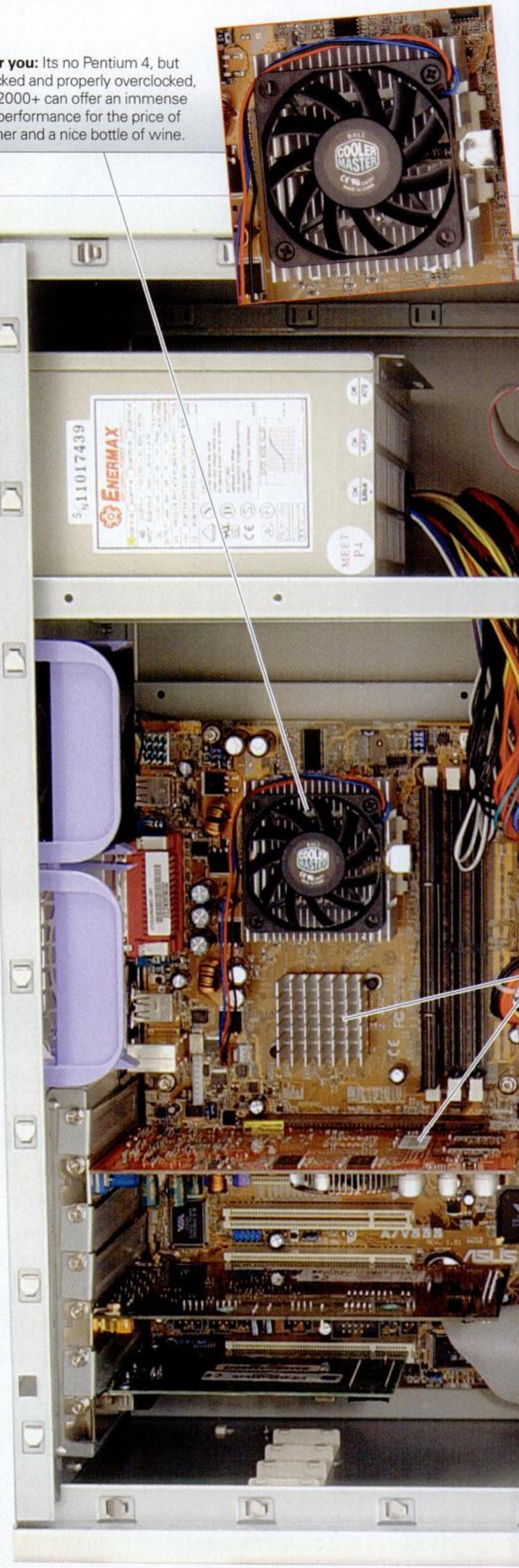
So that's what's *under* the hood. The hood itself is an Enermax FS-710 with a 300W power supply. It's not much to look at, but it's cheap and laden with features: a power supply unit, case fan, removable 3.5-inch drive bays, drive rails, and a neato bay door.

Other incidentals included a no-name floppy drive, the cheapest CPU cooler we could find, Windows XP Home, and an Athlon XP unlocking kit.

SHOPPING LIST

COMPONENT	PRICE*
CASE: Enermax FS-710 with 300W PSU	$65
FLOPPY: generic	$9
NIC: 3COM 3c905b	$20
CPU COOLER: Coolermaster DP5-6I31C-A1	$7
MOBO: ASUS A7V333	$124
HARD DRIVE: 80GB Western Digital WD800JB	$105
VIDEO: Gainward GeForce4 Ti 4600	$175
CPU: Athlon XP 2000+	$130
RAM: Corsair CMX512-2700C2 (512MB)	$129
DVD: Pioneer 16x	$35
CD-RW: Lite-On 32x	$45
SOUNDCARD: Audigy OEM	$45
OS: Win XP Upgrade/OEM	$99
UNLOCKING KIT: Highspeed PC	$12
TOTAL	**$1,000**

**Average of three lowest online prices as of July 2002*



Burning for you: Its no Pentium 4, but when unlocked and properly overclocked, the Athlon 2000+ can offer an immense amount of performance for the price of a steak dinner and a nice bottle of wine.

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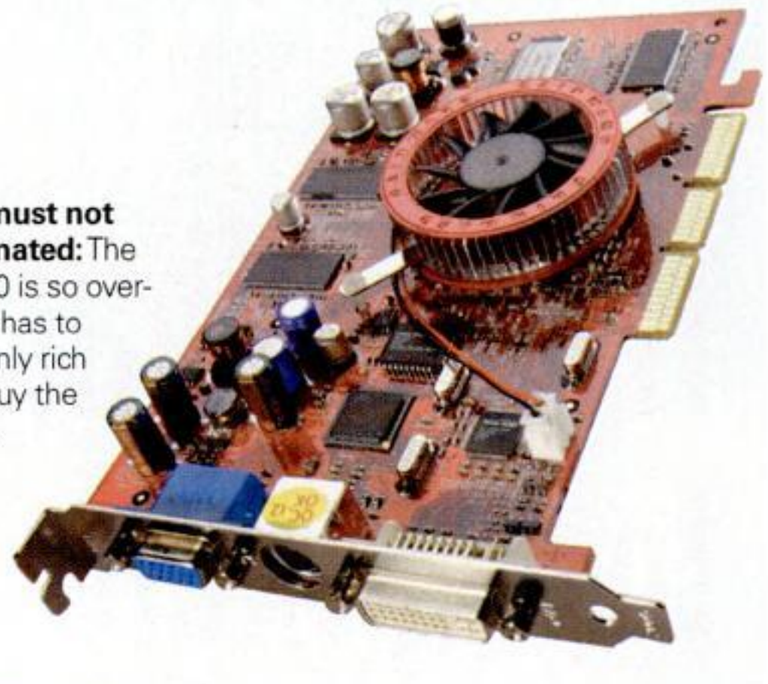
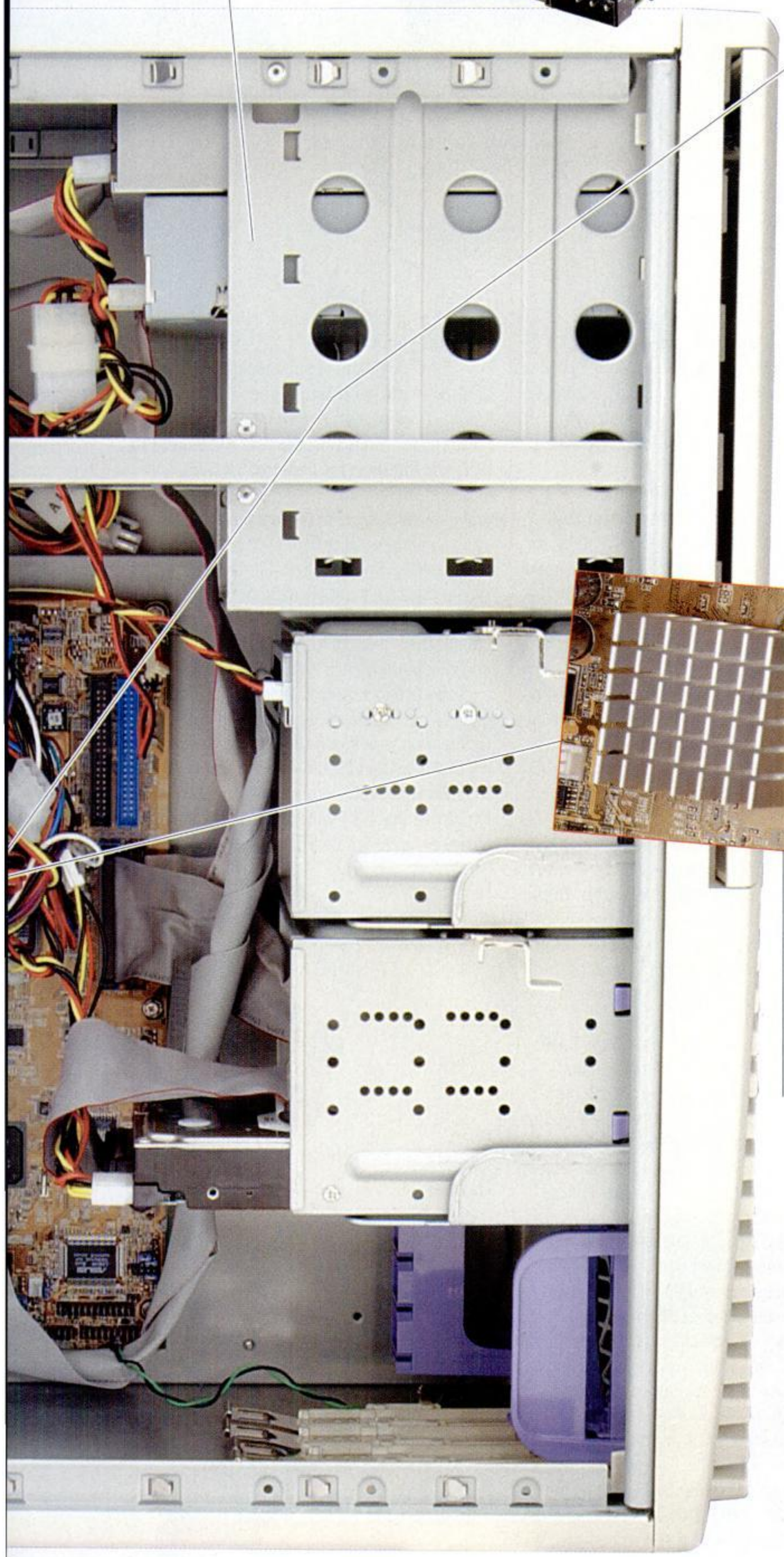
Hard and fast: The Western Digital "Jumbo Buffer" series is fast as hell, keeping up with some of the latest 10,000rpm SCSI drives in sequential reads.



Wily silicon; must not be underestimated: The GeForce4 4200 is so over-clockable, one has to assume that only rich bastards will buy the 4600 versions.

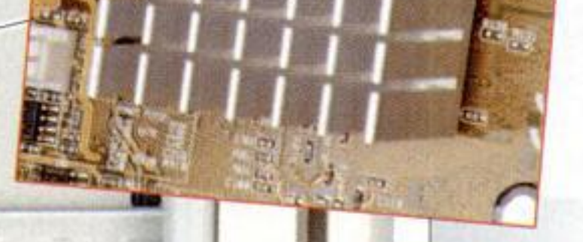


Instant Modifications

To get the most bang for our buck, we overclocked everything possible. It was most critical to open up the bottleneck that's slowing down all of today's Athlon XP systems: the frontside bus, which, at 133MHz, hasn't kept pace with near-monthly advances in CPU and memory speeds. Indeed, AMD processors and DDR memory have been getting faster and faster, but the rate at which they communicate has not.

Unfortunately, it's nearly impossible to dramatically overclock an Athlon system's frontside bus without putting the CPU into a danger zone. Dig: If we wanted to push the bus from 133MHz to 168MHz, our 1.67GHz processor would hit an ungodly 2.1GHz, because its multiplier is locked at 12.5 (168 x 12.5 = 2,100). Hence our need for an unlocking kit to remove the restriction that all Athlons bear straight from the factory.

After using the kit, we moved our Athlon XP 2000+ to a 10.5 multiplier, then set the Asus bus to 168MHz, giving us a resulting CPU clock speed of 1.76GHz. Not bad, considering the age of Athlon process. The upshot is that our frontside bus was finally paying respect to our DDR333 memory, which was running only slightly out-of-spec at 336MHz. We also pushed our Gainward videocard from a 250MHz core/222MHz memory to a 315MHz core/280MHz memory, all without artifacts or other visual quality degradations.

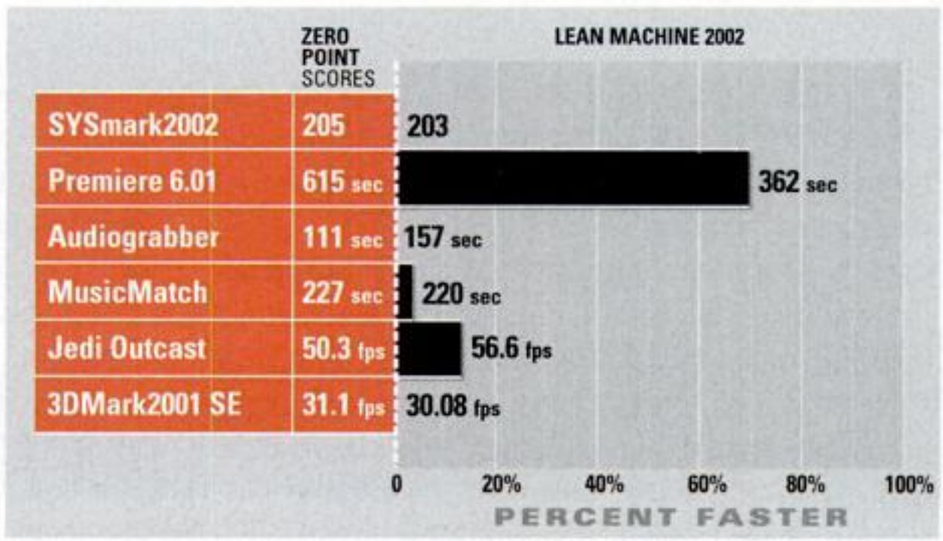


42 fins to overclocking goodness: The serious heatsink on our north-bridge chip comes in handy when the bus is pushed from 133MHz to 168MHz.

Time Trials

The benchmarks speak for themselves. We saw the first Athlon machine to break the 200-point barrier in *SYSmark2002,* the highest *Premiere* score we've ever witnessed, and 3D frame rates that equal and even exceed those of the zero-point system (which houses a much more expensive videocard).

Is the Lean Machine a great value? Obviously. A record-breaker? We never saw it coming. There's little doubt that for $1,000, anyone can have performance for cheap.



Our zero-point system includes: an Intel D850MV motherboard, a 2GHz P4 CPU, 512MB PC800 RDRAM, a GeForce4 Ti 4600 videocard, and a Western Digital 1000BB hard drive (2MB cache).

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Lean Machine 2002

I'd Buy That for $1,000!

How each intern would upgrade his own personal Lean Machine

Even the best budget jobs leave hardcore hackers wanting more, so here's how we'd improve the Lean Machine if Phillips were foolish enough to not only let us *hold* $1,000, but also spend it on new equipment. Price quotes were averaged from the three lowest prices found online in mid-July.

JOHNATHAN Oh, hell, let's raze the whole damn thing. For starters, I went with a different case—the stylish **Directron "Hydraulic" Mid-tower** ($50), which gets its name from a futuristic sliding front-panel. Once you see the front-mounted USB ports, you'll love this case, too. A **420-watt Silence TT-420SS** ($62) is a wise power supply for power-hungry hardware fiends, and a **19-inch ViewSonic E90F CRT** ($250) is a stellar value—besides great picture quality, it has a four-port USB hub. The *only* speaker choice is the **Klipsch 5.1** ($365). 'Nuff said.

The **Logitech Internet Navigator USB/PS2** ($30) is a first-rate, reliable keyboard, and I matched it up with an **Intellimouse Optical 1.1 Special Edition** ($35), which has an ambidextrous design, improved DPI over the original, and those bad-ass little Teflon feet. I also grabbed two **Microsoft Gamepad Pros** ($25 each) for console ports and old-school emulators.

Additional cooling comes in the form of a **Card Cooler XT** ($25) and a **CoolerMaster HHC-001** copper heatpipe CPU cooler ($33). Finally, an **ATI TV Wonder VE** ($45) makes the Lean Machine a complete entertainment package. Now we can watch and record TV, play console ports, and listen to DVDs in true 5.1 surround sound—all on the same machine!

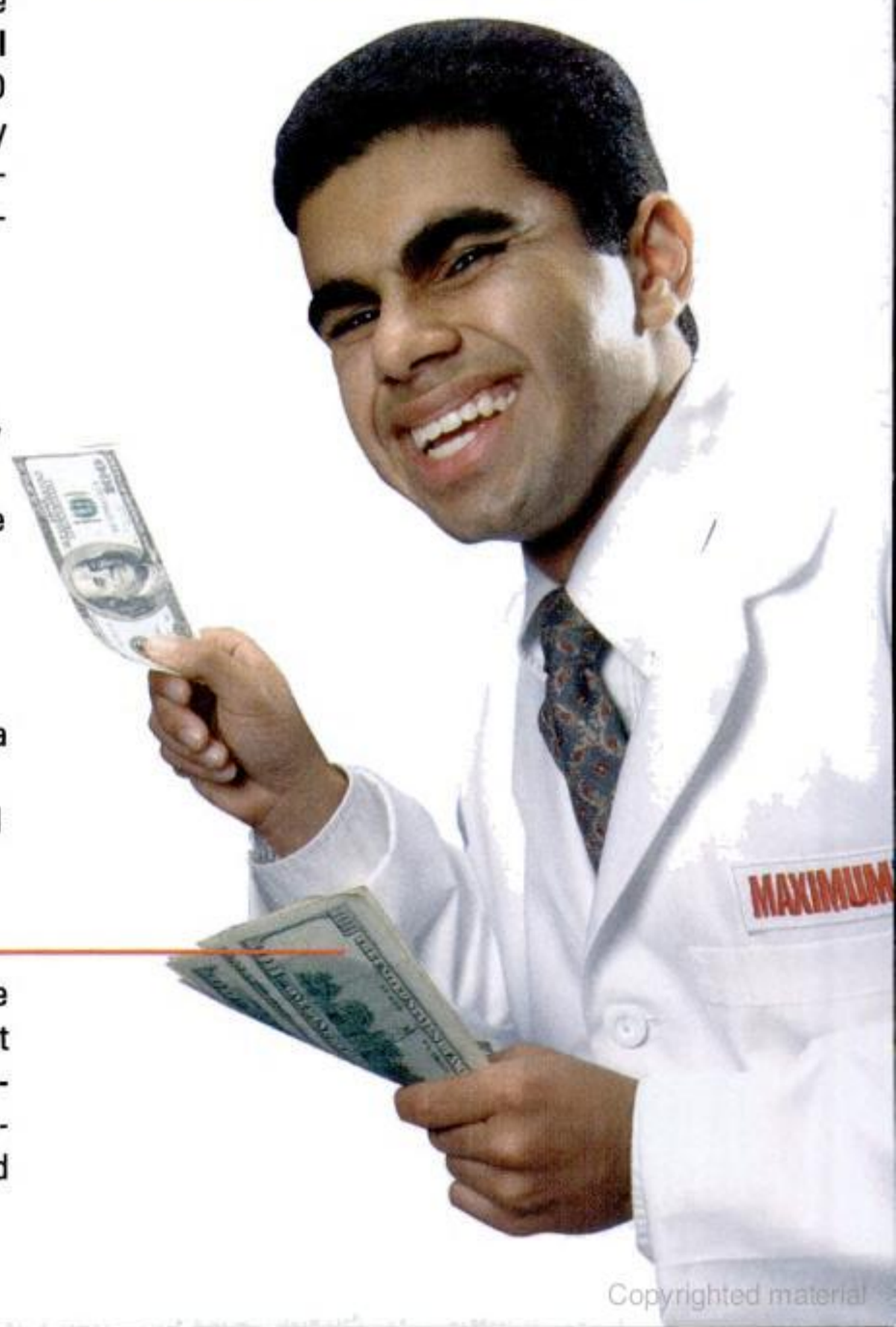
BRIAN I'll stick with our CPU, because the overclocked Athlon is already running at near 2200+ levels, and building a P4 setup would mean ripping out the Lean Machine's current foundation. New videocard? No thanks. For the money, you can't show me a better value card than our OC'd Ti 4200. Hard drives? Now you're talking. I'd add another **80GB Western Digital 800JB drive** ($107) and fire up the unused RAID controller on our ASUS motherboard for roughly *double* the Lean Machine's stock disk performance. Stripes please, and I'll be crossing my fingers against data corruption.

For peripherals, I'd start with a **Sony E540 flat-screen CRT** ($495). At 21 inches, it's Sony's largest budget Trinitron and can run 1920x1400. For speakers, I'd team the Lean Machine's Audigy soundcard with a set of **Klipsch 5.1 speakers** ($365). They're expensive, but the Klipsch/Creative Labs duo is a standard for good reason. I could certainly spend less money on the monitor and speakers, but good A/V can last several years (unlike most internal system components, which can become obsolete overnight). Finally, I'd grab a **92mm intake fan and another 80mm exhaust fan** ($15) to protect our overclocked parts, then spend a dollar at one of San Francisco's sidewalk junk sales for my mouse and keyboard.

OMEED Because I'd primarily be using the Lean Machine for gaming, the first thing I'd buy is a perfectly flat CRT, such as the **19-inch NEC FE991SB** ($302). This aperture-grille display's picture quality brings a tear to my eye, and since it's a CRT, it's better suited than any flat-panel for games.

Until I manage to successfully wire a computer directly into my brain, I'll need a keyboard and mouse. I'm a sucker for fancy-boy ergonomics, so I'd spring for **Microsoft's Natural Keyboard Pro** ($27) and **Intellimouse Explorer 3.0** ($25). The mouse's side buttons are a godsend for web surfing and game playing, and the latest rev of this mouse sports an improved optical sensor for more accurate tracking. Once I'm prowling the halls of Castle Wolfenstein, I'll want my neighbors to hear every bullet leaving the barrel of my MP40. Thus, I'd allocate $245 for a set of **Klipsch Promedia 4.1** speakers, which deliver 400 watts of crystal-clear sound.

Equipped with the above peripherals, the Lean Machine should be able to hold down the fort for the next few months. I'm saving the balance of my $1,000 budget for the All-in-Wonder version of **ATI's Radeon 9700.** I don't know how fast, stable, or expensive this GPU will be, so I'm holding out for it purely on good faith. ATI, don't disappoint me! ■



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the Audigy™ is a no-brainer."

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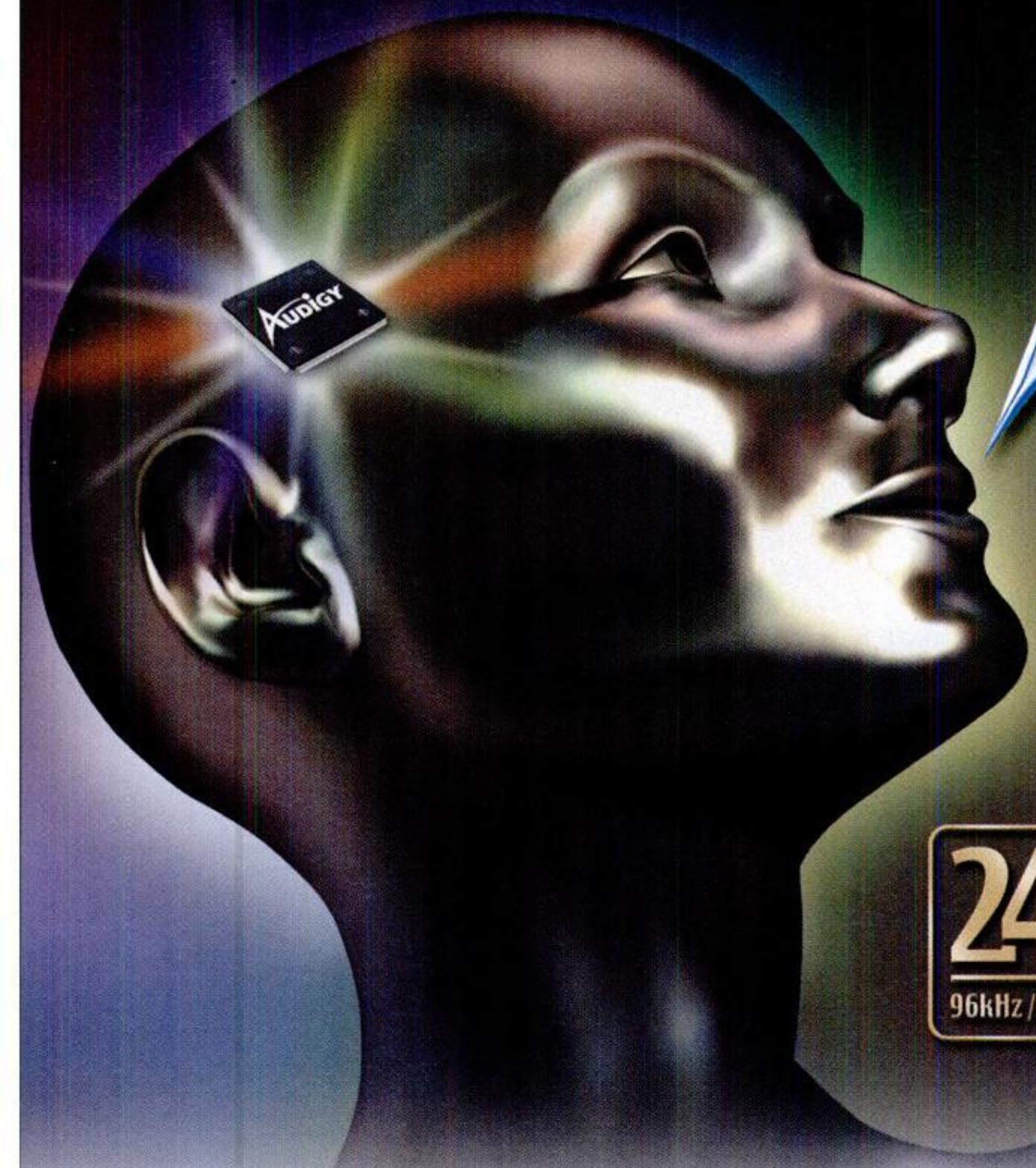

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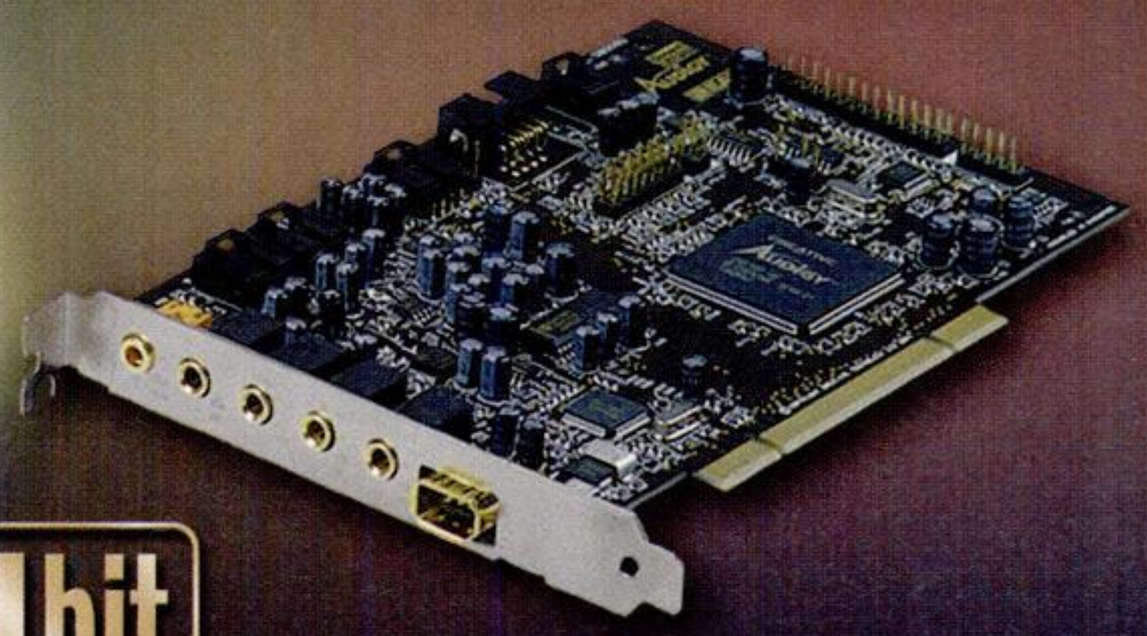

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PC GAMER EDITORS' CHOICE

GEAR OF THE YEAR

MAXIMUM PC KICK ASS PRODUCT

ZDNet Editors' Choice

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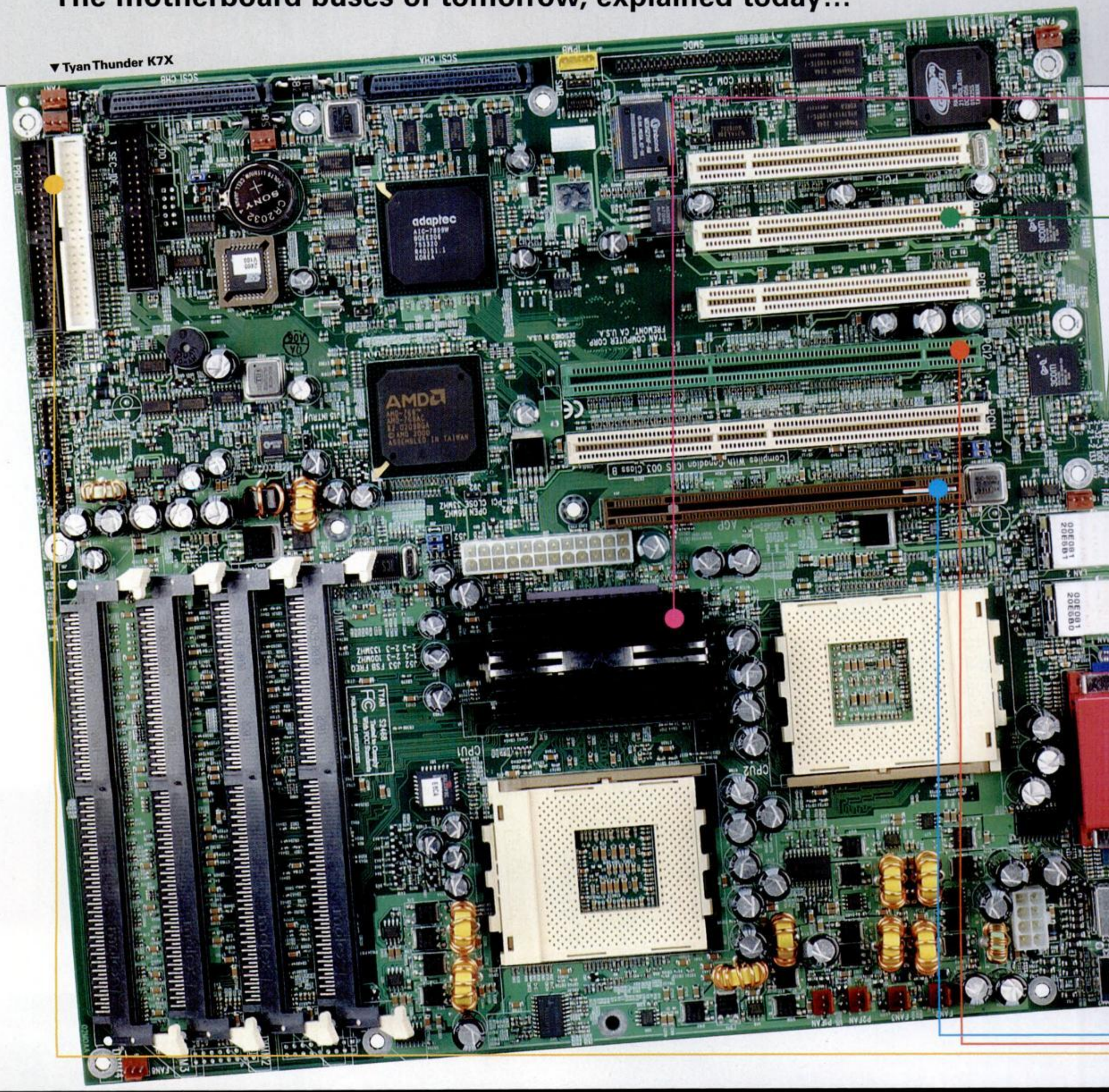
LIFE in the FAST LANE

The motherboard buses of tomorrow, explained today…

▼ Tyan Thunder K7X



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Fast cars aren't any fun in crosstown traffic jams. Mull that one over as you wait for your kick-ass PC to squeeze its data through the skimpy paths provided by today's motherboard buses. The familiar PCI bus—now 10 years old—is just one standard that can't keep up with the traffic generated by today's CPUs, hard drives, and peripherals working in concert.

A bus is simply a conduit for data traveling from one place to another: from your CPU to RAM, from your videocard to your CPU, and even between two computers. Turn a motherboard upside down, and you can literally see some of the data paths along the underside of the circuit board. A bus standard is defined by the voltages, connectors, protocols, and timings that comprise these paths. The standard determines bus bandwidth and speed limit, and the bandwidth and speed limit determine how fast your data can move. If data can't be moved between your CPU and RAM quickly enough, your CPU will be bottlenecked. Don't believe us? Then consider the tangible speed boost the Pentium 4 received when it graduated from a 100MHz to 133MHz quad-pumped bus. Moreover, if your hard drive, videocard, and soundcard are all competing for space on a single bus, then your PC's overall performance will suffer.

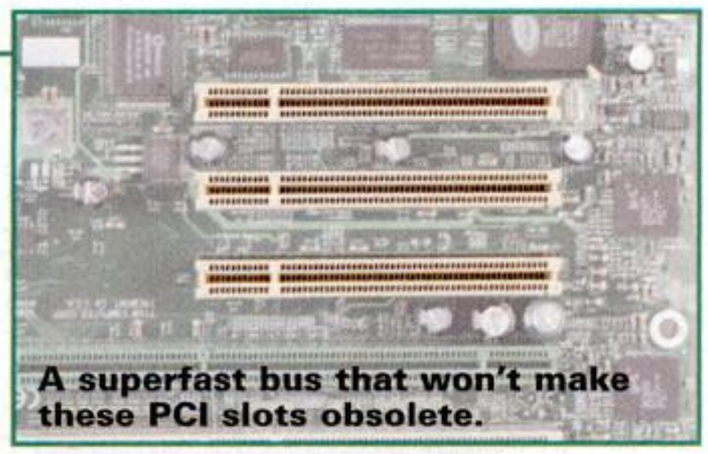
And that's exactly what's happening today. It's time for change, and change is finally on its way.

The next-generation buses described in this article do much more than simply widen freeways and raise speed limits. These new technologies are also going to revolutionize how traffic moves *through* freeways. They pack data closer together, time it more carefully, and open up additional on-ramps and off-ramps. They will fundamentally alter, often invisibly, the way PC components communicate.

And when you put them together, you'll be able to watch your PC *really* fly.

—MIKE MADDOX

PCI Express



A superfast bus that won't make these PCI slots obsolete.

AKA	3GIO/Arapahoe
Connects	CPU and memory to PCI cards
Bit width	1x, 2x, 4x, 8x, 16x, and 32x lanes
Throughput	2.5Gb/sec each direction per bit width of bus; scalable to 10Gb/sec per bit each direction
ETA	2004
Developer	PCI SIG (trade association led by Intel)

PCI Express is promising to bring humongous increases in both sheer peripheral bandwidth and system design flexibility. At the same time, you won't need to toss out your existing PCI cards or overhaul your operating system. These are some big promises, and while PCI-SIG members approved the basic PCI Express specifications this summer, it may be a while before mobo manufacturers and system OEMs begin implementing the technology.

Current PCI slots send their data back and forth via copper traces. These traces connect the multiple expansion slots in parallel and give them a straight shot to your CPU and RAM. Because the same bus is shared among all the expansion slots, the total amount of data flowing in every direction—to and from peripherals—is limited to a maximum of 133MB/sec. Protocol overhead limits the usable capacity to about half that. Combine multiple ATA/133 drives, a high-speed optical drive, and a network card in the same PC, and the result will be similar to an hysterical mob rushing the fire exit: Nothing will get through quickly or easily.

PCI Express is slated to blow away this bottleneck by jacking up the transfer rate per copper trace—*way* up, to 2.5Gb/sec in each direction. PCI Express will also provide simultaneous point-to-point links between devices. These multiple independent transfers could, for example, allow data to be transferred from a hard drive to a network card at the very same time that data is flowing from the CPU to the videocard. The closest that today's PCI bus comes to approaching this scheme is by alternating the 32-bit chunks of one transfer with those of another—and each chunk subtracts from that insufferable 133MB/sec limit.

It's important to understand that, as a spec, PCI Express actually has two related components. One is a set of electrical interface standards that define how a PCI Express expansion card talks to the rest of the computer: timing, connector pin assignments, voltages, and so on. The other is a set of protocols that describes the underlying bus that shuttles data from the CPU/memory complex to an expansion slot. Because the new PCI Express bus standard doesn't render existing PCI connectors obsolete, you'll still be able to buy regular PCI cards for a long time, and you'll still find at least a few old-school PCI slots on mobos even after PCI Express begins rolling out in earnest.

Each PCI Express connection is called a "lane," and the lanes will be between 1-bit and 16-bits wide, allowing a huge range of scaling for future expansion. Desktop PCs will initially use 1-bit lanes for all but the graphics interface, which will warrant a 16-bit lane. (That's right: PCI Express can handle graphics, and this *might* spell the end of AGP.) Machines needing server-class I/O capabilities will get 4-bit and 8-bit lanes.

The PCI Express spec also accommodates external devices. Imagine an external hard drive that runs just as fast as the one inside your rig. Or a PC bisected into two, smaller boxes connected by the PCI Express bus: one containing hotter components and their annoying fans near the floor, and another that puts peripherals and ports on your desktop where they're needed most.

All of the features that allow an OS to recognize and configure devices, like Windows Plug and Play, remain intact in the PCI Express spec. The spec is also software-agnostic, and IRQs will be history. However, taking full advantage of the hot-plug capabilities of PCI Express *will* require OS updates. Luckily, there will be plenty of time for those to be developed: We don't expect to see any motherboards or devices using PCI Express until 2004.

HyperTransport 2.0

Chipsetville gets a new highway system.

AKA	Lightning Data Transport (LDT)
Connects	Different motherboard chips (CPUs and core-logic chips), point-to-point
Bit width	2x, 4x. 8x, 16x, or 32x bits
Throughput	Up to 12.8GB/sec (6.4GB/sec each way)
ETA	Now playing in nForce boards
Developer	HyperTransport Consortium (trade association led by AMD)

A lot of issues limit how fast data can travel on the buses that your cards, drives, and peripherals use. For example, mechanical hard drives can spin only so quickly, so developing a multigigabyte-per-second bus for them would

■ **A note on abbreviations:** MB/sec (large "B") indicates mega*bytes* per second, while Mb/sec (small "b") indicates mega*bits* per second. GB/sec refers to giga*bytes*, while Gb/sec refers to giga*bits*. For the record, 1 byte = 8 bits.

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be serious overkill. PCI cards, meanwhile, require low-cost connectors that keep PCs within the economic reach of normal human beings. And so on.

But your CPU, chipset, and memory are a different story. They comprise what is essentially the nervous system of your PC and must operate at warp-factor speeds. In order to minimize the amount of time that any one of these components waits for data from any of the others, the components' shared bus should be throttled up as high as possible.

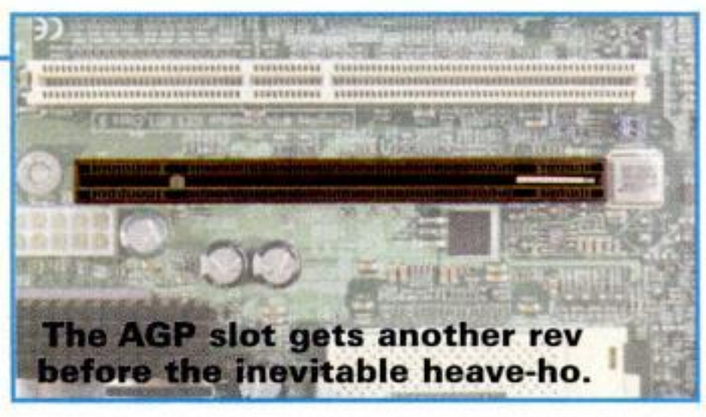
That's where HyperTransport comes in. Developed by AMD but now licensed to companies like nVidia and Sun, it's a fat pipe for the brains of your system, pushing 6.4GB/sec of data each way, for a total bandwidth of 12.8GB/sec. At the same time, by minimizing the number of copper traces needed between chips, HyperTransport reduces the cost of implementation as well as power consumption.

HyperTransport requires a small chunk of real estate from chips on each end of the interface, plus copper traces in between. Like PCI Express, data is "packetized" in much the same way your TCP/IP connection works.

Because HyperTransport was intended as an interconnect between chips, you won't find a HyperTransport expansion card advertised in your Sunday paper. But nVidia's nForce platform processing architecture already uses it, and we expect to see more platforms on the way soon.

A HyperTransport bus could carry data from a southbridge chip to a daisy chain of HT-to-PCI bridge chips, thus permitting the transparent use of current PCI card technology, even while boosting the underlying bandwidth.

AGP 8x



The AGP slot gets another rev before the inevitable heave-ho.

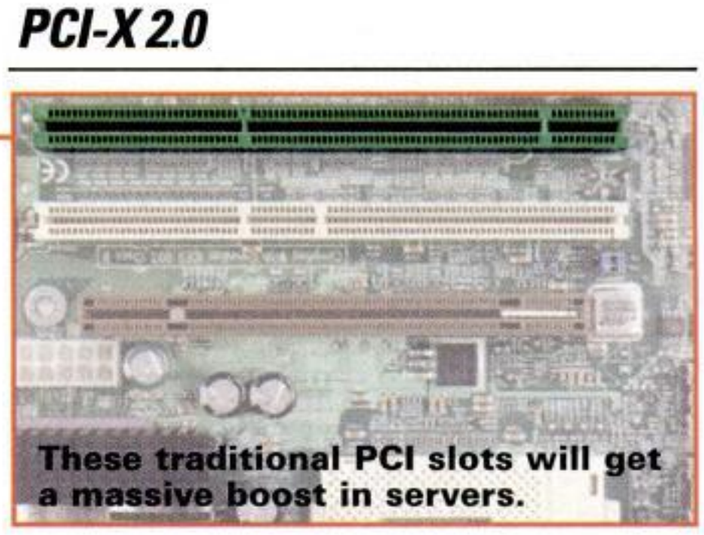
AKA	AGP 3.0
Connects	CPU/memory complex to display card
Bit width	32x
Throughput	2.1GB/sec
ETA	Q3/Q4 2003
Developer	Intel

When games that used 3D accelerators started showing up, it became pretty clear that our graphics accelerators deserved a very, very special place in our motherboards. We didn't want to see our texture data, for example, stuck in the same narrow PCI queue as everything else. AGP relieved the PCI bus of all its video data traffic and provided an express lane for 3D-accelerated graphics.

Videocard GPUs continue to become more and more powerful, so naturally, AGP needs to keep well ahead of the curve. Enter AGP 8x, which hoists the maximum throughput ceiling to 2.1GB/sec! The other major change is a reduction in voltage levels to 0.8v. Integrated circuits can be pushed to much higher frequencies with lower voltage levels, and AGP 8x actually requires the drop in order to hit its effective 533MHz clock rate (66MHz octuple-pumped). Lower voltage also reduces crosstalk (that is, noise) between data lines, helping to boost the reliable clock rate.

The only downside to the new spec is that AGP 8x slots won't support cards that are AGP 2x or below. Not that you'd still be using one of those, anyway. We anticipate that the AGP bus and PCI Express will converge after AGP 8x. AGP, like the VESA Local Bus spec that preceded it, was a stopgap to meet the demands of data-hungry display cards. Once PCI Express is a reality, it should meet the needs of next-generation videocards—the ones that will be running *Toy Story*–quality games.

PCI-X 2.0



These traditional PCI slots will get a massive boost in servers.

Connects	CPU/memory to PCI cards
Bit width	64
Throughput	2GB/sec up to 4GB/sec
ETA	Q1 2003
Developer	PCI SIG (trade association led by Intel)

Servers have a far more rapacious appetite for motherboard bandwidth than do ordinary PCs. Database and file servers with multiple CPUs and hard drives can flood a single system I/O bus with hundreds of I/Os per second, and all of this data has to be accommodated quickly and without incident. The original PCI bus put harsh limits on the total I/O bandwidth a server could sustain, so Intel responded with a series of PCI boosts that most desktop users aren't even aware of.

For example, PCI 2.2, which first started seeing hardware support in 1999, offered multiple combinations of bus widths and clock rates; maximum transfer rates ranged from 133 to 533MB/sec. PCI-X 1.0 later bumped the bus width/clock rate ceiling even further to 1GB/sec.

PCI-X 2.0 will build on a staggering array of bit-width and clock-rate specs. With a 133MHz clock, a PCI-X 266 bus will capture data twice per clock (double data rate, or DDR, not to be confused with DDR memory technology), for an overall bandwidth of 2GB/sec. Meanwhile, a PCI-X 533 bus will capture data four times per clock (quad data rate, or QDR), for an overall bandwidth of 4GB/sec.

PCI-SIG representatives estimate that PCI-X 2.0 devices (servers and expansion cards) may be available as soon as early 2003. PCI-X 1.0 cards will work fine in 2.0 slots, and vice versa, thanks to auto-sensing technology. This is important for both end-users and manufacturers because no one wants to throw out disk controllers, Fiber-Channel host adapters, and network interface cards, to name just a few expansion cards.

We'd all love to get our hands on the superbandwidth of PCI-X 2.0 buses, but they were designed for high-end server applications and are priced accordingly. Views differ on the long-term positioning of PCI-X vs. PCI Express for servers. Here's the *Maximum PC* take on it: PCI-X will win out in servers for the next several years, but it may have hit a practical, cost-effective limit due to its 64-bit bus and quad–data rate clocking. PCI Express is more scalable in the long term and will eventually supplant PCI-X.

Infiniband

Connects	Servers to I/O devices (disks, network adapters)
Bit width	One (serial)
Throughput	2.5Gb/sec and up
ETA	Now
Developer	Infiniband Trade Association

Although Infiniband may be the least interesting bus to anyone but data center managers and their direct superiors, it's worth knowing about if only for the cool name.

Infiniband is often referred to as a "fabric." This fabric is a mesh of super high-speed Infiniband links and switches that connects servers to storage subsystems, network interfaces, and other I/O devices. Infiniband was once expected to overtake PCI as the bus standard, but ever since Intel's decision to leave the Infiniband chip market, it seems clear that it will remain stuck in stodgy server environments.

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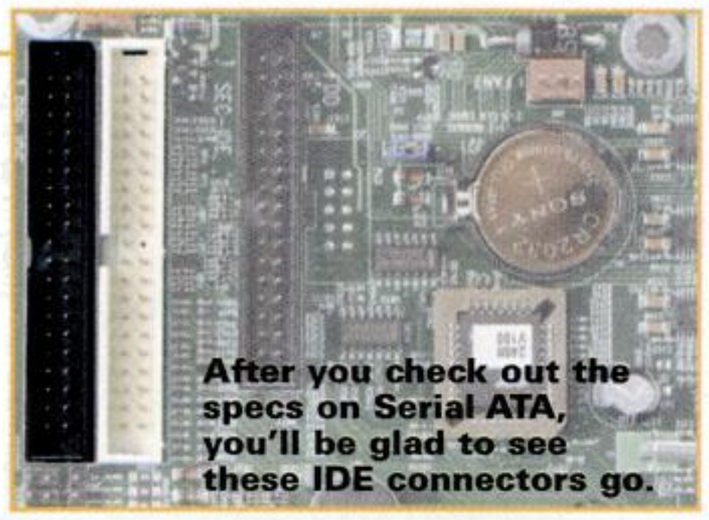
Serial ATA



AKA	SATA
Connects	Hard disk controller to hard disk drives
Bit width	1x
Throughput	150MB/sec initially; 300 MB/sec and higher in future generations
ETA	Q3/Q4 2003
Developer	Serial ATA Working Group (a trade association)

The ancient ATA disk interface endures despite a mountain of evidence that its days were numbered ages ago. First, your ATA cable (an IDE cable by any other name) is limited to 18 inches, hamstringing case layouts as well as limiting the practical number of disk drives in a case. Second, even the 80-conductor cable required by ATA/100 and ATA/133 devices can't sustain any further bandwidth increases. Arguably even worse, these ribbon cables can hinder airflow, a critical issue with CPUs and videocards that threaten to run hotter and hotter. And, finally, the master/slave architecture of parallel ATA prevents simultaneous I/Os to devices sharing a single channel.

Enter Serial ATA, which tackles these issues at every point. The smaller, round cable that Serial ATA uses can extend up to a meter, giving system designers more flexibility and promoting airflow within the case. The new spec also offers a substantial bandwidth boost of up to 150MB/sec *per channel*. And each Serial ATA drive runs on its own separate channel, allowing simultaneous transfers.

Serial ATA also offers a surprising improvement in data integrity. Unlike the old ATA spec, Serial ATA command packets are protected with a CRC (cyclic redundancy check). Theoretically, if a bit in a parallel ATA write command is dropped, the command could send data to the wrong place on the drive, corrupting a random file (an unlikely occurrence, we admit). The new CRC protection isn't absolutely ironclad, but offers a new level of confidence where it's needed most.

RAID designs will be simpler with Serial ATA, because each drive is on an independent channel. In fact, because RAID controllers are most often found on add-in cards, Serial ATA controllers are likely to appear on RAID controllers before they're integrated into mobos.

The new Serial ATA spec reduces the number of signal lines from 26 to four, which in turn reduces the number of chip-level transistors needed to drive all those lines (as well as cutting down on the number of connector pins). This economical design helps drive down overall costs.

Of course, in order to take advantage of Serial ATA, you'll need both a Serial ATA motherboard (or controller card) and a Serial ATA hard drive. The first Serial ATA hard drives were demo'd almost a year ago, and the first production drives will likely ship in small quantities by the end of this year. Keep in mind that the Serial ATA rollout may well be the most dramatic transition the PC market has ever seen, so it will likely be painfully slow.

The first Serial ATA motherboards are expected to smooth the transition by offering both parallel ATA ports and Serial ATA ports. We expect this kind of configuration to be common by the end of 2003. ■

Get on the MiniBus!

The two major peripheral standards—USB 2.0 and FireWire—are getting a makeover of their own

USB 2.0

At 480Mb/sec, USB 2.0 puts the USB standard into bandwidth territory previously occupied only by FireWire. That's 40 times the speed of the USB 1.1, while maintaining backwards compatibility with USB 1.1 devices. It uses the same cables and connectors as before. Motherboards are already available today with USB 2.0 support, matching hundreds of USB devices.

The USB 2.0 rollout got shot in the kneecaps, however, by Microsoft's lack of OS support with the initial release of Windows XP. Luckily, XP-native drivers have since been released and are available on Microsoft's web site at www.microsoft.com.

AKA	Universal Serial Bus 2.0
Connects	Computer to printers, scanners, mice, etc.
Bit width	1x, bidirectional
Throughput	480Mb/sec
Max devices on chain	127, with maximum fan-out of hubs (eg., hubs plugged into each other for up to five levels)
Hot plug?	Yes

FireWire 1394b

Initially, the next iteration of FireWire (also known as IEEE-1394b) will offer speeds of up to 800Mb/sec using Category 5 unshielded twisted pair (UTP) cables, which can extend to 100 meters. But pair up your peripherals with shielded twisted pair (STP) cables, and you'll be gunning for speeds up to 1.6Gb/sec.

But wait, there's more. If you use glass or plastic-fiber STP cables, you'll be eligible for a speed boost to a whopping 3.2Gb/sec! Expect to see the first 1394b products later this year, followed by motherboards with integrated 1394b about six months later.

Backwards-compatibility is still unclear. When we know, you'll know.

AKA	FireWire b, iLink (Sony)
Connects	Computer to video and other peripherals
Bit width	1x, bidirectional
Throughput	Up to 1.6Gb/sec on 4.5 meter shielded twisted pair (STP) cable
Max devices on chain	63
Hot plug?	Yes

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WORKHORSES

Welcome to the blue-collar world of workstation videocards, where 3D developers require exacting pixel accuracy, and more than 200MB of memory is far from overkill

From left to right:
nVidia Quadro4 900XGL,
3Dlabs VP870,
ATI FireGL 8800,
3Dlabs Wildcat III 6110

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BY JIM NORRIS

You might think your videocard is the quintessential 3D rendering tool, but to a professional game developer, it's probably nothing more than a woefully inadequate children's toy. Herein lies the paradox of 3D acceleration: Much of the content created for games like *Quake III* is actually developed on videocards that are ill-suited for playing games! Sure, during quality assurance testing, the games are run on the same cards that consumers run at home. But all those 3D objects and animations start life on a class of videocard that's alien to most people outside the design profession.

In the next few pages we'll introduce you to four videocards that are expressly designed for content creation on high-end workstations. And we're not just talking about game development. Workstation cards are also used for authoring all the 3D models and animations you see in movies like *Shrek*, and they're necessary for the exacting detail required by industrial designers. Our tour starts with a look at trade-offs—the features you gain and lose when switching from a gaming card to a workstation-class 3D demon.

Speed vs. Accuracy

Your consumer-level videocard might be fast, but only because its manufacturer optimized the card's drivers for frame rates, then scooted the card out the door before tweaking the drivers further for top-notch visual quality. To put this in perspective, let's take the example of a highly detailed 3D scene. A gaming card might be able to display the scene, but it will do so with cracks in between textures, misplaced pixels, and missing pixels. The rendering defects aren't obvious when you're rushing through an environment at 60 frames per second, because you're more worried about getting your ass blown off than checking out the texture quality. But when you're doing mission-critical design work—such as rotating a fully rendered airplane part in real-time—sub-pixel accuracy is necessary to ensure the integrity of the work at hand.

Because content developers value visual quality over speed, workstation cards come with drivers that are highly tuned for their special needs. Pixels appear exactly where they *must* appear, and textures converge exactly where they *must* converge. Oftentimes, workstation drivers also include special tweaks that allow a card to crunch as many polygons as its architecture will afford; you just won't find these tweaks in consumer-level drivers.

A close look at how different videocards handle the OpenGL spec can shed light on the subject of driver optimization. OpenGL, of course, is the programming interface that drives all the games based on the *Quake III* engine. That's how *you* know it. But OpenGL is also used for all types of 3D development and is an industry standard that extends far beyond the world of gaming.

For all intents and purposes, running an OpenGL app on a workstation is the same as running an OpenGL app on a desktop rig—you can load *Jedi Outcast* on a workstation and zip around without much of a problem. The difference lies in the *level* of OpenGL support that's built into the hardware and coded into the drivers. OpenGL is a huge, all-encompassing graphics standard, and different videocards enable different parts of the standard. For example, a gaming card will shed acceleration features required in high-end support; its rendering algorithms won't be as precise. So while a high-end workstation card will be able to describe lines A, B, C, D, E, and F, a gaming card will be able to describe only lines A, B, and C—just half as many lines of code (a gross simplification, but you get the point). And what about anti-aliasing? It's long been available in the OpenGL spec, and workstation cards have always taken advantage

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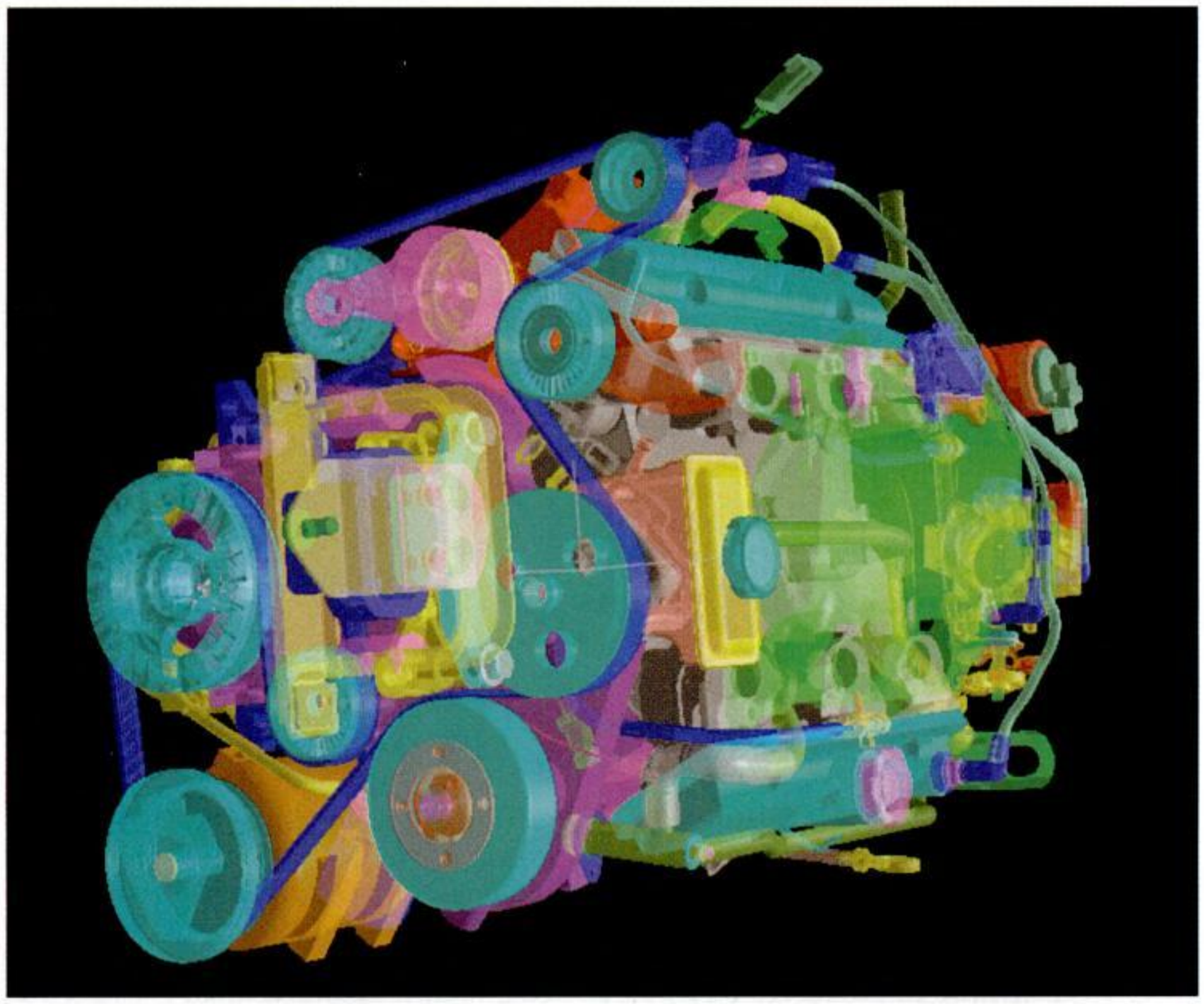
WORKHORSES



This engine model is rendered and manipulated in *Viewperf's Unigraphics* test. Notice the intense concentration of polygons and transparency layers.

of it because it's a must-have feature for 3D developers who want smooth previews. But only in the past few product generations has anti-aliasing been offered as a standard feature in consumer gaming cards.

Once again, speed vs. accuracy emerges as the most salient issue. OpenGL is a language, and just like any language, you can speak it slowly with precise enunciation or quickly with a much less exacting level of definition. Our tests illustrated this difference vividly. We ran *LightWave*, a high-end modeling/rendering app, on all the cards in this roundup, including a regular-old GeForce3 gaming card that we threw in to serve as a baseline comparison. A quick perusal of the benchmark charts on the following pages shows that the gaming card handled *LightWave* with all the swiftness of a workstation card. But at what cost? All its performance was rendered virtually useless by the poor visual quality of the preview. Textures flashed, gridlines distorted, and the view was unacceptable for precision work (see page 53).

Let's Get Certified

Videocard drivers optimized for speed at the expense of accuracy take much less time to develop. This helps lower the price of consumer-level videocards and allows the cards to be brought to market much more quickly. On the flipside, workstation drivers require months of development and certification—time is money, and the costs are passed on to the people who buy the cards. Similar in concept to WHQL driver certification for Windows, workstation videocard companies must submit drivers to application developers, who then run the drivers through a vigorous series of tests over an extended period of time. Driver revisions that pass muster are eventually cleared for official use. This is an extremely critical process because application developers will deny tech support to 3D designers who use uncertified drivers. Driver support essentially defines a workstation card's pedigree, and no smart content designer will invest in a card that lacks a full laundry list of certifications.

Sometimes driver development goes even further. Many software companies encourage the development of custom drivers designed to directly interface with their own applications. Discreet's *3ds max* is probably the most widely known of these packages—its custom "Maxtreme" drivers provide superior performance and quality when running that application. But once again, driver development drives up costs. Factor in the immense amount of onboard memory that some workstation cards boast, and suddenly your videocard exceeds the $1,500 mark. Still, precise drivers are mandatory, and only the largest frame buffers allow you to manipulate oodles of gigantic textures on the fly.

OpenGL packages such as *LightWave* and *3ds max* provide game developers with shaded, anti-aliased, textured previews, in which they can manipulate fully rendered objects instead of just primitives or wireframe models. This is probably what most *Maximum PC* readers think of when they hear the term "3D development." But there are more important apps in the workstation world, and outside of game development, most pros won't touch *3ds max*.

For movie and TV work, content developers generally use *Softimage XSI* or *Maya*, and a separate rendering engine such as Pixar's *Renderman*. In the world of industrial design, the stakes are even higher. Packages like Dassault's *Catia*, IGS's *Pro/Engineer*, and EDS's *Unigraphics* are used to create everything from ketchup bottles to car frames, and this is where visual quality and geometric accuracy are particularly important. Improperly rendered views can result in manufacturing delays and even errors that can wreck an entire company. Packages like *Unigraphics* need to be able to render textures down to the stitching on a virtual car's seats and display numerous levels of transparency with complete, legible accuracy. Mistakes in product development can lead to recalls and lawsuits, whereas a mistake in *Shrek* probably won't affect the movie studio's bottom line.

The Benchmarks

We used SPEC's venerable *Viewperf 7* to test our review units' OpenGL prowess. This ever-evolving benchmark executes sections of code from *3ds max*, *Unigraphics*, *Pro/Engineer*, *DesignReview*, *Data Explorer*, and *Lightscape*, providing a good approximation of the card's real-world ability in each app. Scores are reported in frames per second; higher scores are better. Full information on each of the benchmarks, as well as the installer itself, can be found at **www.spec.org**. In addition to *Viewperf 7*, we ran our own *LightWave* test by opening the default "Hummer" scene and timing the creation of a 210-frame OpenGL preview. Scores are reported in total seconds; lower scores are better.

For non-timed, real-world testing, we also used the cards to create and modify scenes of varying complexity in *Maya* and *Softimage*. Lastly, we ran the *Jedi Outcast* standard timedemo (the one built into the game—JK2ffa/Bespin—not the timedemo used for desktop system reviews) to see how well each card fared in regular-old gaming. All cards were run with their latest recommended driver versions on fresh installs of Windows XP Professional (for benchmarking) and Windows 2000 Professional (for visual quality assessments). All the apps were originally designed for Win2000, and some sources have reported slight glitches when running them on WinXP.

We used a Dell 530 Workstation as our videocard test bed. This system uses the Intel 860 chipset, dual 2GHz Pentium 4 Xeon 2 processors, a quad-pumped 100MHz frontside bus, and 512MB of PC800 RDRAM. Benchmark scores are reported in each individual card review. Please note that we present two scores for each test. The first score (printed in yellow) represents the performance of the card being reviewed. The second score (printed in white) represents the performance of a baseline GeForce3 Ti 200 card.

And with that, let's get down to work...

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3Dlabs Wildcat III 6110

Grandpa Godzilla—the aging beast still has life

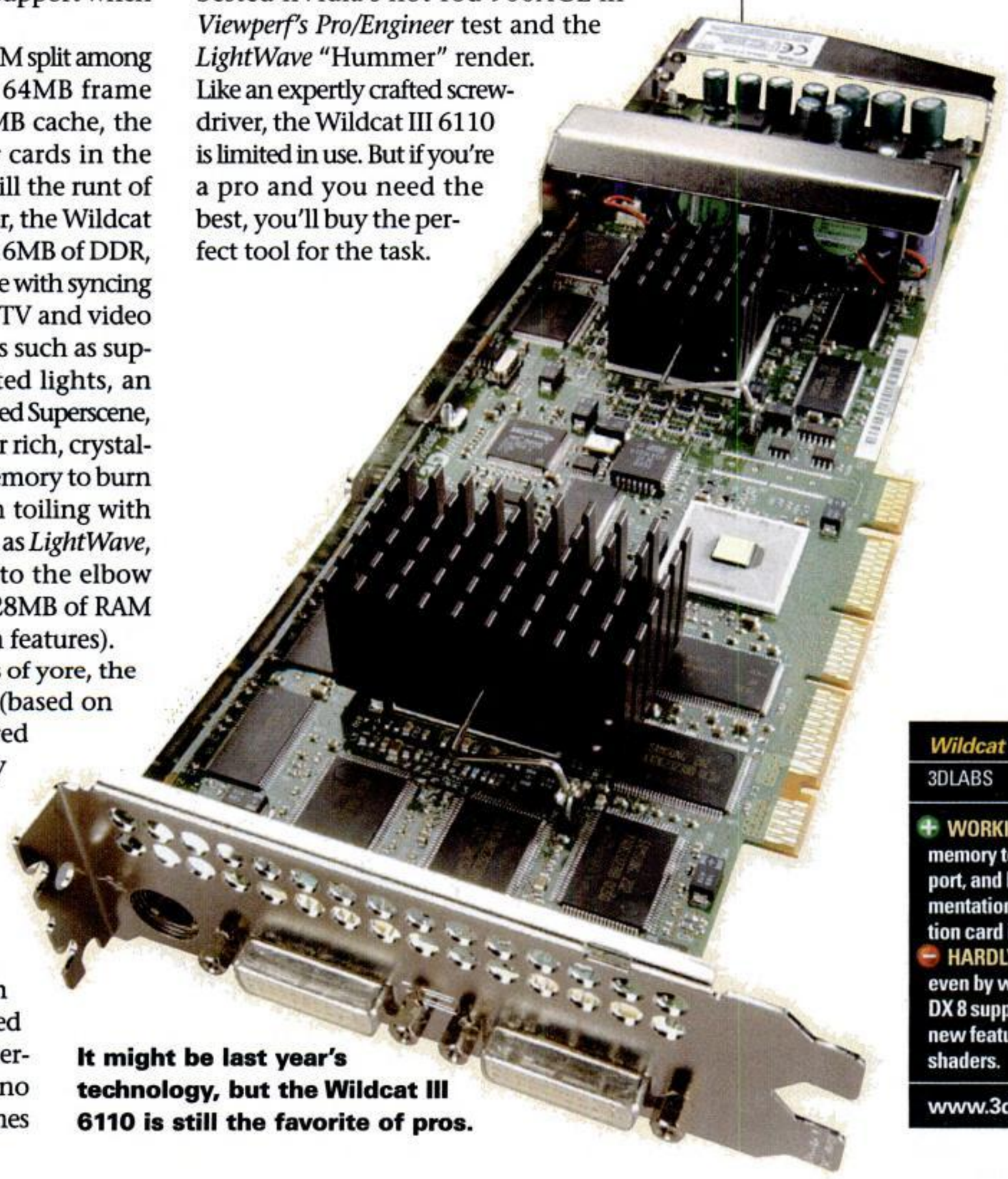
The 3Dlabs Wildcat III 6110 and 6210 represent the pinnacle of traditional workstation 3D accelerators (emphasis on traditional), and the 6110 we tested provided the best user experience of all the cards in this roundup. This is no surprise, as the 6110 is both the highest-priced card we tested and the most favored among old-school professionals.

Physically huge, the card is a multichip design that occupies a full-length, double-wide AGP Pro 50 slot. In fact, any adjacent PCI slot would be obstructed by the 6110's heatsinks and other bits of protruding hardware. Power drain is immense, as the monster demands 50 watts of juice. If you're wondering if your rig is up to spec, don't bother. The card is sold only in preconfigured systems from 3Dlabs-certified vendors, although the brave can find it on the gray market or on eBay. You might be reluctant to choke down the cost of a full workstation just to buy a specific videocard, but you'll benefit from greater system stability as well as highly effective tech support when you ring in with a problem.

Boasting 208MB of DDR SDRAM split among 128MB of texture memory, a 64MB frame buffer, and a highly tuned 16MB cache, the 6110 pulls ahead of the other cards in the memory department, but it's still the runt of the 3Dlabs family. Its big brother, the Wildcat III 6210, features an amazing 416MB of DDR, and has a built-in genlock interface with syncing functions for use with external TV and video apps. Both cards feature niceties such as support for 32 hardware-accelerated lights, an advanced form of anti-aliasing called Superscene, and dual 320MHz RAMDACs for rich, crystal-clear images. Having texture memory to burn is a liberating experience when toiling with megabyte-munching apps such as *LightWave*, and once you've gotten used to the elbow room, it's hard to go back to 128MB of RAM (which is what the competition features).

Like most workstation chips of yore, the Wildcat III's core architecture (based on technology that 3Dlabs acquired from Intergraph) is designed solely around OpenGL acceleration and is tuned for specific apps used by the 3D development community. When running those apps, quality and performance were outstanding. More so than any other card in this roundup, the 6110 illustrated the difference between consumer- and pro-level videocards. With no DirectX 8 support, most new games are verboten on the 6110—and token DirectX 7 support was just recently added. Games using OpenGL interfaces are supported, but perform modestly by gaming card standards. *Jedi Outcast* played like a slideshow, but nonetheless demonstrated the superb rendering quality one expects from a workstation card. Meanwhile, during runs of *Serious Sam SE*, the 6110 showed a texture crispness and alignment accuracy that was clearly superior to not only consumer cards, but also the other workstation cards examined in this article.

In high-end 3D apps, the 6110's increased accuracy paid off big-time with fewer of the mistakes that lead to costly scene re-renders. Rendering performance was also surprisingly fast given the Wildcat's aging architecture. While games proceeded at a leisurely pace, OpenGL performance in 3D apps was quite good, better in most cases than the brand-new FireGL 8800, which is based on modern ATI silicon. In fact, the ancient 3Dlabs card even bested nVidia's hot-rod 900XGL in *Viewperf's Pro/Engineer* test and the *LightWave* "Hummer" render. Like an expertly crafted screwdriver, the Wildcat III 6110 is limited in use. But if you're a pro and you need the best, you'll buy the perfect tool for the task.



It might be last year's technology, but the Wildcat III 6110 is still the favorite of pros.

SPECS

Core: ***Wildcat III multichip array***

Core clock: ***222MHz (geometry engine); 213MHz (rasterization engine)***

Memory: ***DDR SDRAM; 208MB total***

Connectors: ***Two DVI, one stereo***

OS support: ***WinXP/2000; no DirectX 8 support***

WILDCAT BENCHMARKS

LIGHTWAVE	**84** 88
3DS MAX	**9.7** 4.0
DESIGN REVIEW	**33.4** 19.0
DATA EXPLORER	**48.4** 16.3
LIGHTSCAPE	**10.8** 8.0
PRO/ENGINEER	**13.1** 6.0
UNIGRAPHICS	**10.8** 2.7
JEDI OUTCAST	**2.2** 71.6

Scores in yellow were achieved by the Wildcat III 6110. Scores in white were achieved by a baseline GF3 gaming card. The *LightWave* test score is represented in total seconds (lower is better). All other test scores are represented in frames per second (higher is better).

VERDICT

Wildcat 6110	$1,500
3DLABS	*optional part in pre-configured systems*

WORKING HARD: Amazing quality, memory to burn, best software support, and best OpenGL driver implementation. Last year's best workstation card is still damn good.

HARDLY WORKING: Price is high even by workstation standards. No DX 8 support, and it's missing new features like pixel shaders.

8

www.3dlabs.com

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nVidia Quadro4 900XGL

All the speed money can buy

The 900XGL represents the current trend in workstation graphics. Based on the GeForce4, it rides piggyback on all the R&D that was done for nVidia's line of gaming cards. But the consumer core was just a starting point, as the Quadro4 features additional hardware support for anti-aliased lines, greater polygon performance, and a three-pin connector for stereoscopic displays (gone is the S-video connector you'll find on all the gaming cards).

nVidia says the GeForce4 and Quadro4 versions of the NV25 GPU are significantly different, and this seemed to bear out during testing: The Quadro4 demonstrated better texture alignment, texture quality, and anti-aliasing than GeForce4 cards, though it wasn't quite up to the level of 3Dlabs's Wildcat III. However, the Quadro4 does trump the Wildcat by providing full support for DX 8.1 and Win9X onwards, making it the only card in the roundup that can use all its goodies to maximum effect in *any* of Microsoft's relevant operating systems. And that DirectX support isn't token; cursory benchmarking runs produced *3DMark2001* scores that matched the swiftest of today's gaming cards (not a bad bonus for a card that's directed at content developers).

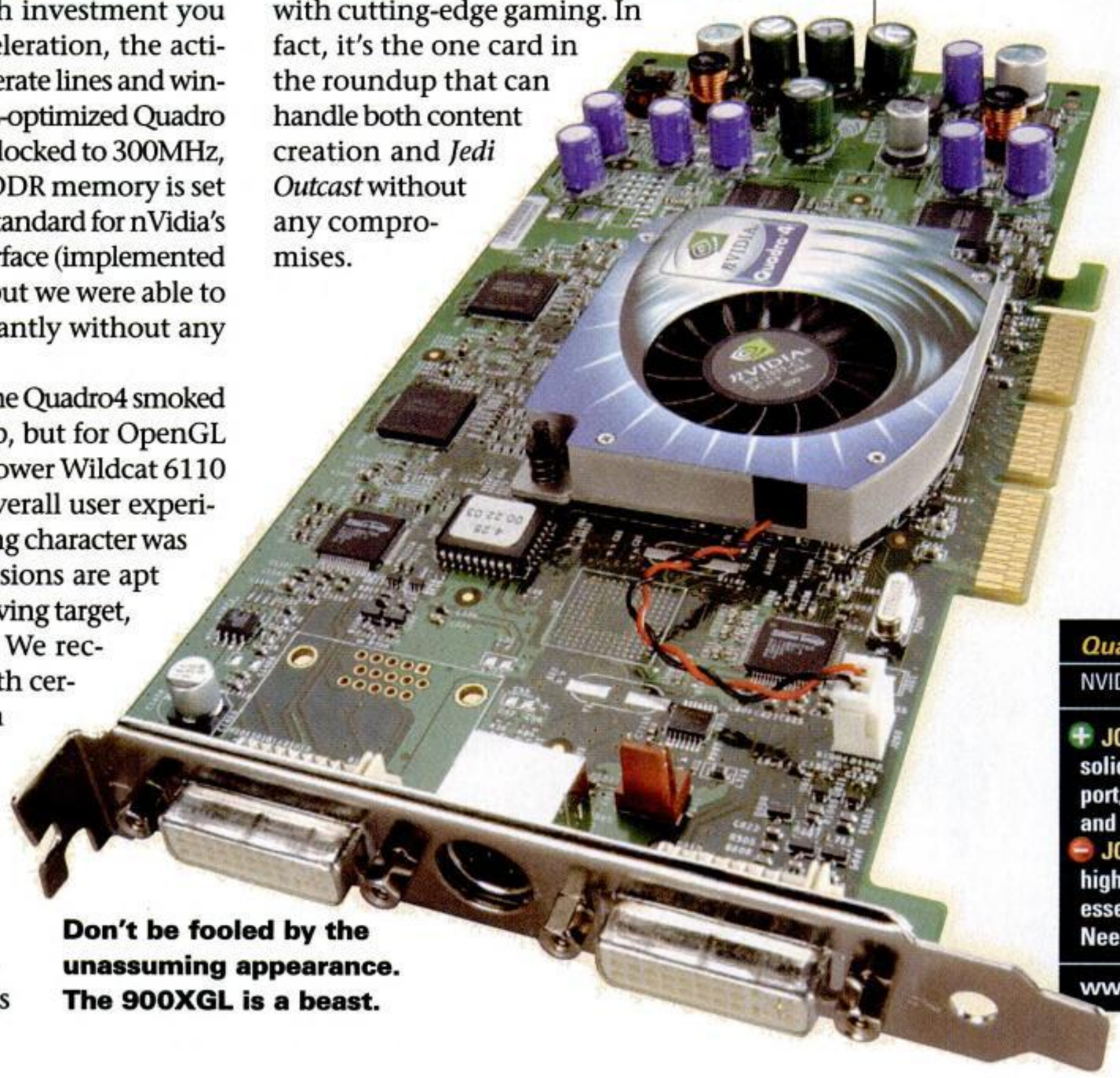
The 900XGL looks much like its GeForce4 counterpart but costs more than four times as much. For your outlandish investment you get increased triangle acceleration, the activation of features that accelerate lines and windows, and access to OpenGL-optimized Quadro drivers. The board's core is clocked to 300MHz, while its double-pumped DDR memory is set to 325MHz. Both specs are standard for nVidia's current fastest memory interface (implemented in the GeForce4 Ti 4600), but we were able to overclock the card significantly without any apparent loss of stability.

During benchmarking, the Quadro4 smoked other cards in the roundup, but for OpenGL apps, we'd still prefer the slower Wildcat 6110 because it offers a better overall user experience. The Quadro's rendering character was quite good, but driver revisions are apt to make visual quality a moving target, so your results may vary. We recommend that you stick with certified drivers, even though they may be several revisions older than the latest ones available for download (different driver revs are often recommended for different apps). nVidia's list of certifications is impressive, and if you're a pro, it's likely you'll find that your app of choice is supported.

nVidia also deserves a special mention for its *nView* display management software, which has always been tops in its category. Gearheads and gamers are just beginning to embrace multi-monitor configs, but content designers have been running them for quite some time. Stepping in where Windows itself comes up short, *nView* provides features such as automatic window sizing, display selection when opening apps, multiple UNIX-like virtual desktops, window transparency, and other features that make running a second display all the more useful. ATI also provides some of this functionality, but its Hydravison package isn't quite so elegant or useful.

The Quadro4 itself is a great tool, but it's also augmented by a vast library of utilities. For example, *RivaTuner* and *NVMax* are invaluable for power users looking to eliminate visual problems in drivers or boost specific areas of performance. There's just nothing like going deep into a set of utility options and setting card properties for yourself. This level of tweaking is simply out of the question with the Wildcat III 6110.

The 900XGL offers the best of both worlds: top-notch workstation technology along with cutting-edge gaming. In fact, it's the one card in the roundup that can handle both content creation and *Jedi Outcast* without any compromises.



Don't be fooled by the unassuming appearance. The 900XGL is a beast.

SPECS

Core: ***nVidia NV25***

Core clock: ***300MHz***

Memory: ***DDR SDRAM, 128MB total***

Connectors: ***Two DVI, one Stereo***

OS support: ***Win9X/2000/XP***

MAXIMUM PC KICK ASS PRODUCT

900XGL BENCHMARKS	
LIGHTWAVE	86 / 88
3DS MAX	11.1 / 4.0
DESIGN REVIEW	46.4 / 19.0
DATA EXPLORER	67.4 / 16.3
LIGHTSCAPE	15.3 / 8.0
PRO/ENGINEER	11.9 / 6.0
UNIGRAPHICS	13.7 / 2.7
JEDI OUTCAST	92.4 / 71.6

Scores in yellow were achieved by the Quadro4. Scores in white were achieved by a baseline GF3 gaming card. The *LightWave* test score is represented in total seconds (lower is better). All other test scores are represented in frames per second (higher is better).

VERDICT

Quadro4 900XGL

NVIDIA — ***$1,650***

JOHN HENRY: Amazing speed, solid OpenGL drivers, full OS support, great gaming. Write the check and you can do it all.

JOHNNY APPLESEED: Extremely high price for a card that's essentially a GeForce4. Needs more memory.

www.nvidia.com

9

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Spells punishing: 26,875

Tournaments underway: 882

Creatures attacking: 49,438

Prizes on the line: 5,000

Deadly strategies: Unlimited

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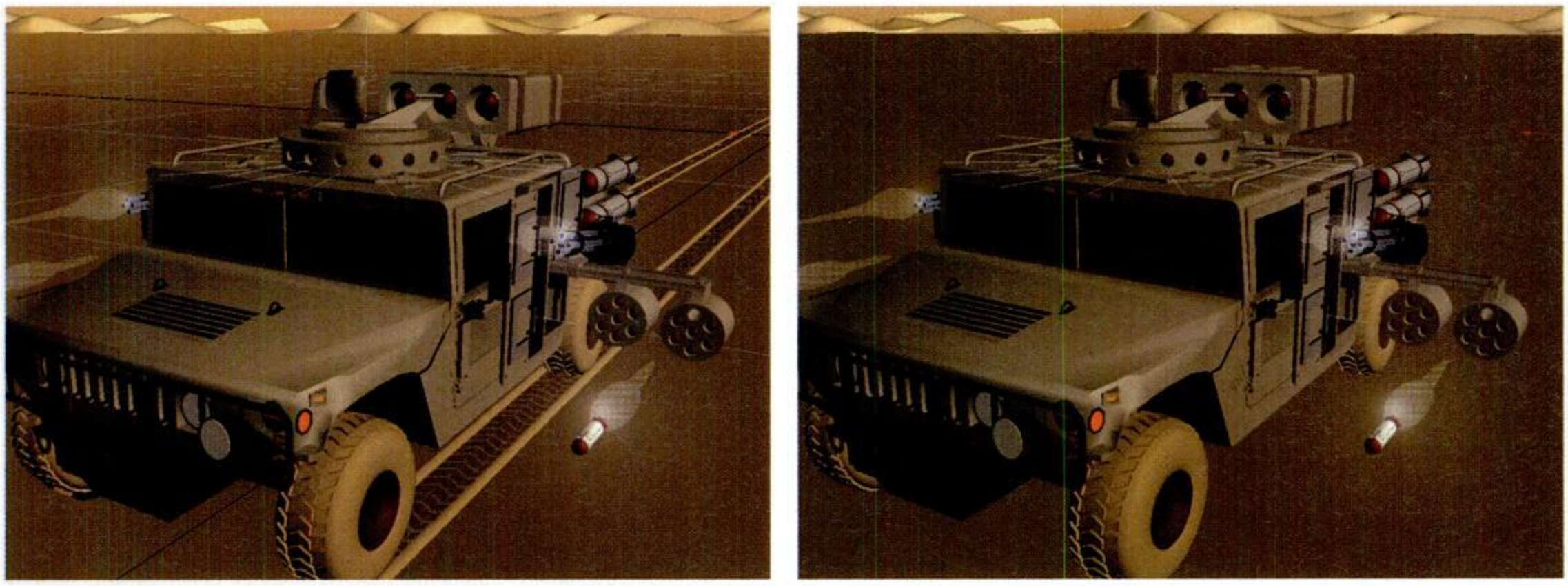


These *LightWave* screenshots reveal why a workstation card is an absolute must. The first shot was rendered by the 3Dlabs Wildcat III—gridlines are crisp and clean, the desert surface is properly shaded near the horizon, the tire tracks are present, and the radiator grill is properly lit. The second shot was rendered by our baseline gaming card—no gridlines, no shading toward the horizon, no tire tracks, and if you look very closely you'll notice the grill is improperly lit.

Preview: 3Dlabs Wildcat VP870

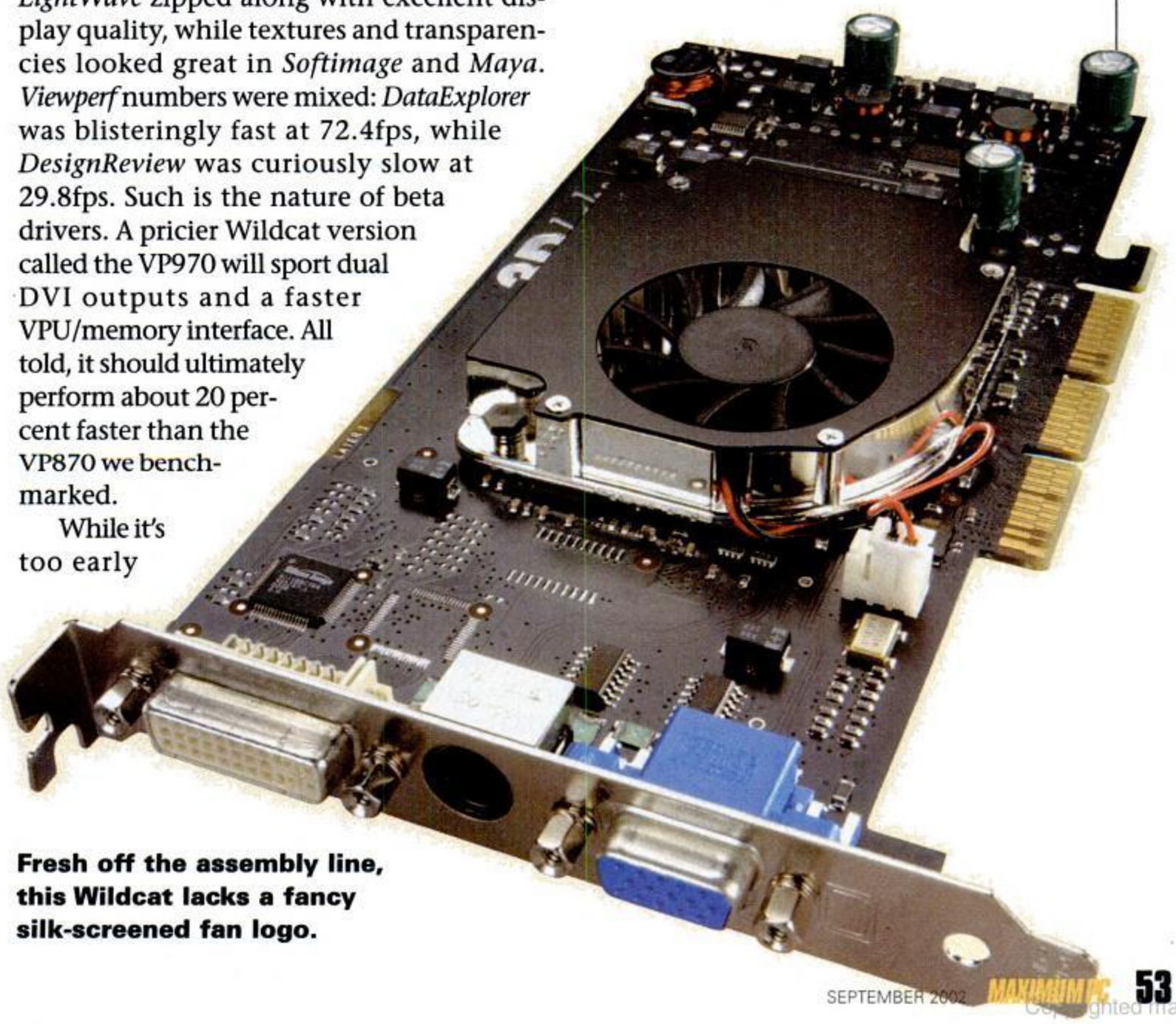
Our first experience with the P10 graphics chip

Received literally just hours before the absolute final deadline for this article, the Wildcat VP870 is the workstation version of the all-new P10 architecture from 3Dlabs. Boasting near-infinite programmability as well as hardware support for the upcoming OpenGL 2.0 standard, the VP will offer previously unavailable features, such as hardware-accelerated procedural textures (textures that never blur nor distort no matter how closely you zoom in on them, much like a postscript font) and the ability to accelerate actual third-party rendering engines, and not just your preview window. The catch? Software will have to be rewritten or modified via a plug-in to take advantage of these features.

Because we received the VP870 under rushed conditions, 3Dlabs could only supply us with beta drivers. Nonetheless, the $600 card impressed us with benchmark numbers that were higher than most of the similarly-priced ATI FireGL's, and visual quality was practically flawless. Unlike older 3Dlabs workstation cards, the VP offers full DirectX support right out of the box, albeit with unspectacular gaming frame rates. Meanwhile, *Jedi Outcast* (an OpenGL game) topped out at 41fps. Our contacts at 3Dlabs assure us that gaming versions of the P10 won't be disappointing, but only time will tell. We currently have no idea how the P10's hardware or drivers will be tweaked once they land in Creative Labs boxes.

The VP870 is a midrange offering, and sports 128MB of DDR memory, dual integrated 370MHz RAMDACs, and both DB15 and DVI connectors. Like nVidia's 900XGL, it also sports a three-pin stereoscopic display adapter. The card was quick and pleasant to use, despite some beta driver instabilities. *LightWave* zipped along with excellent display quality, while textures and transparencies looked great in *Softimage* and *Maya*. *Viewperf* numbers were mixed: *DataExplorer* was blisteringly fast at 72.4fps, while *DesignReview* was curiously slow at 29.8fps. Such is the nature of beta drivers. A pricier Wildcat version called the VP970 will sport dual DVI outputs and a faster VPU/memory interface. All told, it should ultimately perform about 20 percent faster than the VP870 we benchmarked.

While it's too early to give a verdict to the P10 architecture, it's safe to say that the Wildcat VP870 represents the future of workstation cards: They'll all share a single core with gaming accelerators, and they'll all be programmable from top to bottom. ■



Fresh off the assembly line, this Wildcat lacks a fancy silk-screened fan logo.

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Ask the Doctor

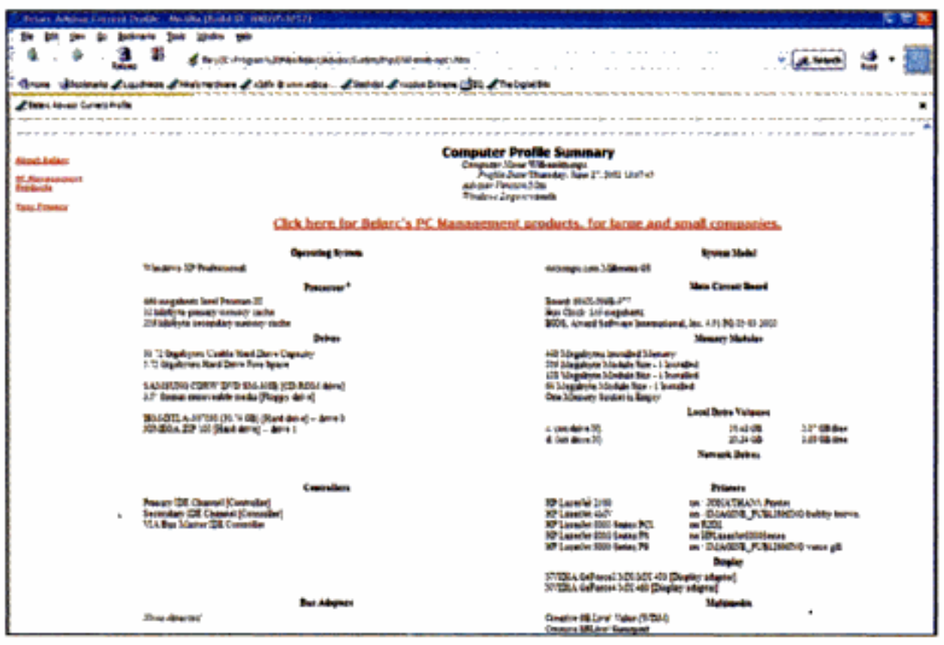
Symptom → Diagnosis → Cure

Have a burning PC problem? How about a burning PC sensation? We're more than happy to help you with your PC problems, but you might want to get that sensation thing checked out by a qualified sensation checker-outer. If you have PC questions, send them to **doctor@maximumpc.com**. Just remember: We can't answer every e-mail. Oh, no—not by a long shot.

Windows XP Won't Let Me Shut Down My PC

I recently did a clean install of Windows XP and have had a lot of little problems, although, the system doesn't crash. My main complaint is that my system takes at least 20 seconds to shut down. I have a 1GHz CPU and 512MB of RAM. Whenever I'm done playing a game like *Counter-Strike,* or something else that stresses my computer, it won't shut down. It just says "Windows is shutting down," then freezes. Please tell me if there is any cure at all for this problem.

—SAM CHEN



Forgoing a fancy interface for the simplicity of an HTML page, Belarc Advisor will scan your PC, then create a report detailing everything from the motherboard brand and model to the number and size of your RAM sticks.

The Doctor hasn't heard of many shutdown problems under Windows XP, and a search of the Microsoft Knowledge Base turned up zilch. However, Microsoft has identified freeze-on-shutdown as a "known issue" (that means bug, for those who don't speak Microsoftese) in some configurations. Cruise on over to Windows Update and make sure you have all the latest patches installed. Also, we know of at least one motherboard that experienced WinXP shutdown problems, which were fixed with a BIOS update. Check out your motherboard manufacturer's web site, and download the latest BIOS to see if that fixes the problem. If you're not sure what motherboard you have, Belarc Advisor is a free program that can identify your mobo as well as offer a veritable treasure trove of information about your entire system. You can download it at www.belarc.com/Download.html.

Laptops, LCDs, and You

I have been trying to bring a Compaq LTE 5280 laptop up to snuff so that a friend can use it to learn about computers and get on the Internet. The laptop uses Windows 98 and works like a charm. The problem is that there's a black border about 1.5-inches all around the display that I can't get rid of. I have reinstalled Win98, gone to the settings tab in the Display Control Panel, and can not change the resolution from 640x480. (I can change to 16-bit or 8-bit color depth but that has no effect.)

I have gone to the Compaq web site and downloaded the recommended version of the driver for the videocard (a Cirrus Logic 7544 PCI), but when I go to "Hardware Check" it states that the driver is current and doesn't need replacing.

—BUD RIGBY

The black border around the edge of your screen is characteristic of many LCD panels. LCDs are built to run at a fixed resolution—800x600 in the case of your laptop. On some LCDs, such as your Compaq's, selecting a non-native resolution will result in a smaller display area. Hence, the black border around your screen.

There are two things that could prevent Windows from displaying at your laptop's native resolution: the videocard drivers or the monitor drivers. We're not exactly sure what "Hardware Check" is, but we recommend installing the latest drivers for your Cirrus Logic adapter, despite what the site recommends. As a general rule, we recommend checking to see if there's a more current monitor .inf file, but we happen to know that there isn't one for your notebook. Finally, Compaq has a newer BIOS for your laptop listed on the support page. As a last resort, you might consider flashing your notebook's BIOS.

9 out of 10 Users Have Outdated 4-in-1 Drivers

I just purchased a new Athlon XP 2100 PC. I have 512MB of PC2700 RAM with a new Gigabyte GA-7VRX KT333 mobo and Leadtek GeForce4 Ti 4400. Every time I try to play a game *(Soldier of Fortune 2, Jedi Outcast, Max Payne),* it either doesn't run at all or it plays for a minute, then freezes. Even the old three finger salute doesn't help me out. This PC has WinXP; could that be the problem?

—CHRIS SMITH

It sounds like your problem may stem from the chipset drivers. When building a system using a VIA-based motherboard, the first thing you want to do after installing Windows is grab the latest 4-in-1 drivers, available at www.viaarena.com. Make sure to install the AGP drivers in particular, as they are often the culprit in video-related problems. You may also want to download the latest Detonator drivers for your videocard from www.nvidia.com.

GTA3 Runs Great, but Looks Funny

I just bought *Grand Theft Auto 3* for my PC. The game runs, but 2-D images are not displayed. The cars, characters, and environments are displayed, but any 2-D images such as health, dialogue, map, and menus do not show. I have a GeForce4 Ti 4600 with 128 MBs. I've updated Windows with every single driver and have Direct X 8.1. I have contacted Rockstar [the developer] but I'm waiting for a response. Your thoughts and suggestions, please!

—DEMETRI BRANIS

When you're having problems with a new game, the first thing to do is check the readme file, usually located in the same directory the game is installed in. You'll find that your particular problem is listed under "Troubleshooting." The problem is specific to Windows XP and nVidia boards—nice QA testing there, guys—and is fixed by downloading and installing a slightly newer version of the D3D8.dll file. You can grab it as a part of this hotfix: http://download.microsoft.com/download/whistler/Patch/Q306676/WXP/EN-US/Q306676_WXP_SP1_x86_ENU.exe.

If reading the readme file doesn't fix your problem, check Windows Update and make sure you've downloaded all the latest patches and compatibility updates. Also, ensure that you have the latest video drivers installed from your chipset manufacturer's site—usually nVidia or ATI—since they often offer better

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performance and compatibility than the video-card manufacturer's drivers. Another good place to look for help is at the game's official site (www.gta3.com), or the publisher's site—in this case, www.take2games.com.

Lost and Found DVD-ROM

I have a Dell Optiplex GX400 that came with Win98SE. I replaced the CD-ROM drive with a Pioneer DVD-116 drive and added a PlexWriter CD burner. Everything worked fine under Win98. A couple months ago I pulled out the 10GB HD that came with the Dell and replaced it with a Maxtor 40GB 7200rpm drive. I loaded a legal copy of Windows XP Professional on the 40GB HD using the DVD drive. (Per Dell's instructions, I flashed the BIOS before installing XP.) Everything works great under XP except for the DVD drive. Windows XP reports that the drive is working OK. The drive will read a CD-ROM's contents but won't run any .exe files. It will recognize DVD discs but won't play any of my DVD movies, except one—*Forbidden Planet*. Go figure! *Power DVD* gives the same error message every time. It says the disc might be scratched or damaged in some way to inhibit playback. And, yes, I upgraded my *Power DVD* program to version 4.0 for XP. The Pioneer DVD-116 drive is on the XP HCL, and I can't find anything about this problem at the Microsoft Knowledge Base. I tried upgrading the firmware for the Pioneer drive, but I get a message saying that the drive can't be found! I checked the IDE connections. The DVD drive is set as master and the CD burner is set as slave. I am an A+ instructor, but this one has me scratching the thinning hair on my head. Any ideas?

—RON COLLINS

First, make sure you have the latest IDE drivers for your motherboard installed. This will ensure that your drives play nice with Windows. If that doesn't solve the problem, try isolating the Pioneer drive on its own IDE channel. Also, check for broken or bent pins on the IDE connectors of both your motherboard and the DVD drive, and try using a different IDE cable. Finally, try throwing the DVD drive in another system and see if it works there—if not, it's very likely that the drive itself is hosed.

What's an Array, Anyway?

When I do a cold start on my PC, there's a flashing message that pops up saying "Scanning IDE Drives," before anything that looks like Windows shows up. The flashing message says "No array is defined." Please explain what this means. No one has been able to answer it yet.

—CHESTER L. MCWHORTER SR.

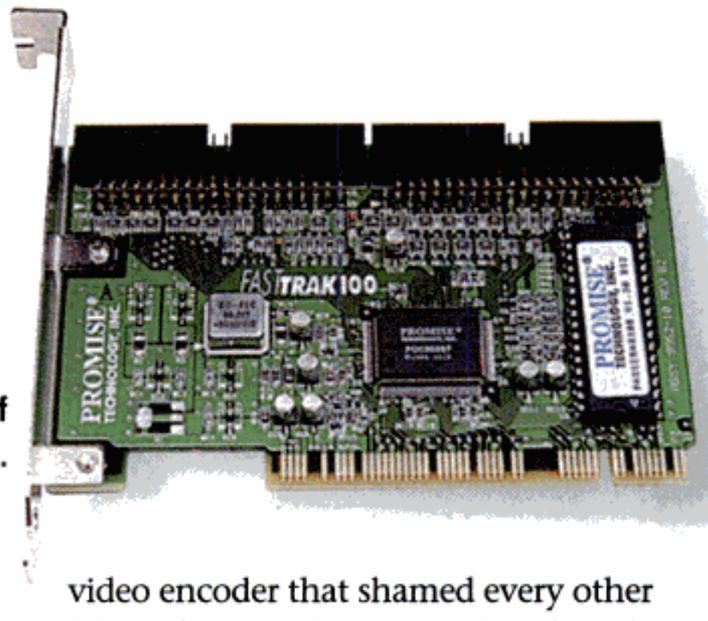
It sounds like your system has a RAID controller that is not being used. You'll probably want to disable the controller. Check your motherboard manual for details, but if you've lost the manual, here's a quick and dirty guide to disabling RAID.

RAID controllers come either as PCI cards or soldered to your motherboard. If your RAID controller is a PCI card, simply open the case, remove the card, and close the case back up. If it's integrated onto your motherboard, you should be able to disable it in the BIOS. Reboot your PC, and press the key to enter your BIOS—it's usually F1, F2, or Delete. Look for a setting such as "Onboard RAID" or "Onboard Promise Chip" (assuming you have a Promise RAID controller).

If, on the other hand, you desire some hot and bothered RAID lovin', Ars Technica has an article at http://arstechnica.com/paedia/r/raid-1.html with a wealth of information on the different flavors of RAID and how they work. Depending on what setup you choose, a RAID array can yield increased performance, protection for your data, or both—but it's certainly not for everyone.

Local Man Creates Superfast PC

I was recently given the task at work to encode and stream video at the highest possible quality and an unrealistically low bandwidth. We needed to prove whether it was possible, not necessarily come up with a scheme to do it. To this end, for instance, many of the best compression techniques require your processor to crunch on the video stream at a rate that drops you below 30fps, and that of course is unacceptable for high-quality streaming. Enter the June *MaximumPC* and the fine print about PC1066 memory. Soon, I had an approved purchase order for a video encoder that shamed every other PC, and several Sun boxes. Based on the Asus P4T533-C and populated with 1GB of Kingston PC1066, I was going to challenge all assumptions. But... there's one snag. The machine boots up one in 12 or 15 times with an "overclocking error." While running Windows XP, it spontaneously reboots. During POST, it comes up as 2.539GHz, not 2.533GHz, and I have to wonder if this tiny margin of error is the cause of my woes. Setting the machine to 120/30 instead of 133/33 (which knocks it down to 2280/480 CPU and FSB) stabilizes the system. What can I do?



While RAID can increase your system's performance and reliability, it's not for everyone. Luckily, we can tell you how to disable it and shave precious seconds off your boot time.

"Soon, I had an approved purchase order for a video encoder that shamed every other PC and several Sun boxes."

Note: Even at 2.280GHz, this machine *hauls ass*. But it's not a "maximum" PC.

—ZACK SARGENT

It sounds like you may have been burned for being an early adopter. Early versions of that board that we've seen in the Lab have had problems with some PC1066 RIMMs but not all. Check with Asus and make sure that the memory you have is recommended to work with the board. While you're at the Asus site, download the latest BIOS update. We aren't able to tell exactly what it fixes, but there's a chance it could fix your problem. If it's too late to exchange the memory you bought for something that's supported by your board, you should still be able to run the system indefinitely at 2.280GHz without problems. And perhaps a future BIOS update will fix your problem.

It's also possible that you were sold a remarked CPU. Intel's Processor Frequency ID Utility, available in the Downloads section of its support web site, is a useful tool for identifying the intended speed of your CPU. You may want to download it and make sure that your P4 is truly a 533MHz FSB model and not a 400MHz imposter. If none of the above yields results, you may have gotten a bum motherboard or memory module. ■

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How To...

A step-by-step guide to tweaking your PC Experience

CLEAN YOUR PC

We checked in with PC, monitor, CD, and laptop manufacturers to find out how they recommend you swab your poop deck

MAXIMUMPC
TIME TO COMPLETION
00:38
HOURS MINUTES

BY WILL SMITH

Never open your PC when your mom is standing nearby. Even if your room or office is spotless, the inside of your PC is certain to be a haven for dust and debris after just a few months of operation. But how do you clean it? Is it safe to use Windex on a monitor screen? Do those optical drive cleaning CDs actually work? What can you do about the dust bunnies lodged into the nooks and crannies of your case's interior?

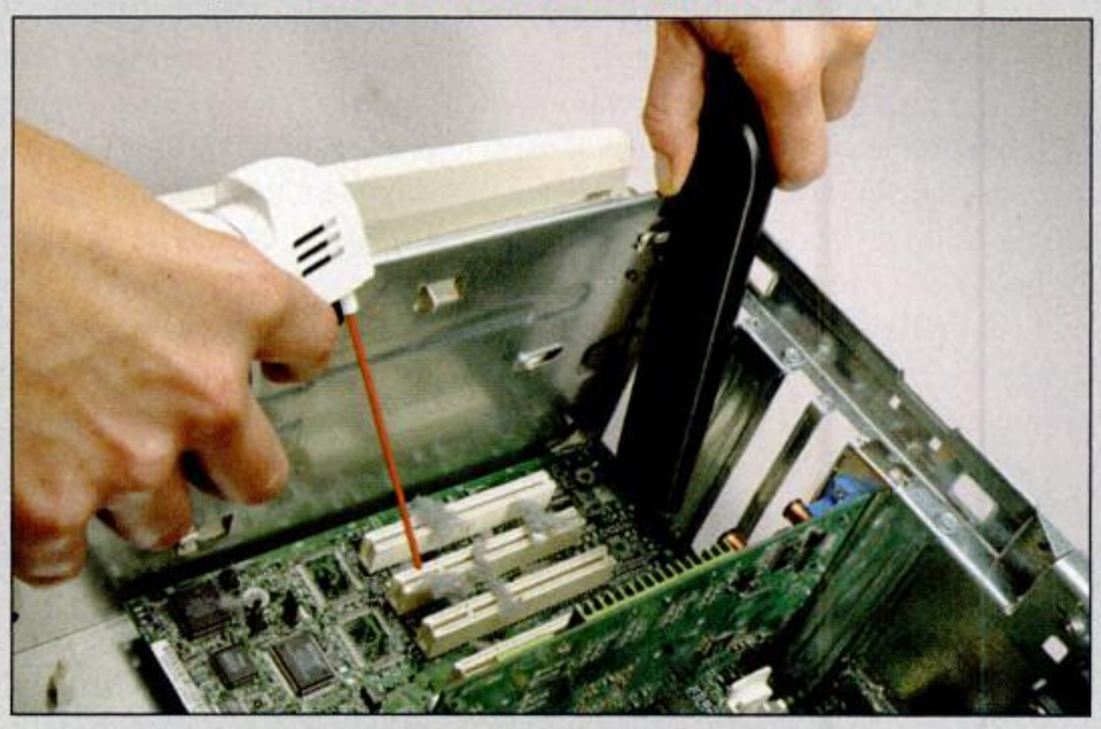
The first thing you should do is consult your hardware vendors' instruction manual or web site for recommended cleaning procedures. If you can't get an answer from your manufacturer, however, here are the lessons we've learned from more than 50 years of combined PC experience and the advice of a few experts.

Case Study 1: CRTs and LCDs

Admit it: Your monitor is no stranger to fingerprints and sneeze effluvium. And while a paper towel and Windex might seem like a good way to rid your screen of the offending smudges, it's really not. Ammonia and other harsh solvents can damage the anti-glare treatment or coating on your flat-panel or CRT.

To protect a screen's surface, we recommend using 3M's Screen Cleaner Kit 675 to clean both LCDs and CRTs. The Screen Cleaner Kit includes an alcohol-based cleaning solution plus 25 antistatic wipes. All you do is spray a little solution on a wipe, then rub the wipe across your screen. Avoid spraying any liquid directly onto your display—even a rivulet of cleaner in your monitor's innards could make for a very bad day.

Case Study 2: Inside Your Desktop's Case



The inside of a PC can be a shockingly dirty place. Seriously, we've seen fist-size dust bunnies sitting alongside $400 videocards. The grime is not only unsightly, but it can muck up your PC's delicate componentry. Dust can seize fan bearings, obstruct the airflow through your case, and wreak havoc when inside of storage drives. Fortunately, cleaning the inside of your PC is both easy and cheap.

First you'll need a can of compressed air. You should be able to find this at any office supply or computer store for less than $5. Next, equip your vacuum cleaner with the crevasse attachment (the one with the narrow pointy end). Use the compressed air to knock dust loose, and the vacuum cleaner to suck it up before it finds shelter someplace else. As a preventative measure, put a filter in front of your intake fan.

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In the Lab

A behind-the-scenes look at Maximum PC testing

Tweak or Cheat?

Mipmap levels wreak havoc in *3DMark2001 SE*

Maximum PC's standing rule for desktop system reviews is that we test and evaluate rigs exactly as they've been shipped. This policy has cut both ways for system vendors.

For example, when a particular PC vendor forgot to switch on DMA support for hard drives and optical drives, we tested the system with DMA turned off. The rig's benchmarks suffered, but we felt it necessary to show potential consumers that the vendor missed an important detail. On the flipside, when vendors send us overclocked systems or optimize their OS builds for better performance, we let these tweaks ride. We don't mind benchmarking an OEM rig that's been tuned for faster performance, just as long as the vendor gives consumers exactly the same tweaks.

In recent months, however, we've noticed that a few system vendors have resorted to an "optimization" that actually *hurts* the consumer: lowering mipmap level detail in order to increase 3D frame rates.

One of our primary benchmarks is Game 4 of *3DMark2001 SE*. Because this benchmark is mostly bottlenecked by a system's videocard, we were surprised when we started seeing scores creep up in different systems running the exact same GeForce4 Ti 4600. When we first started testing this videocard, we found that Game 4 at 1280x1024 hit about 31fps. Whether the card was teamed with an Athlon XP or a higher-clocked Pentium 4, Game 4 frame rates generally didn't change unless the Ti 4600 was overclocked.

On the left, mipmap levels are set to "best image quality." On the right, mipmap levels have been lowered to "best performance."

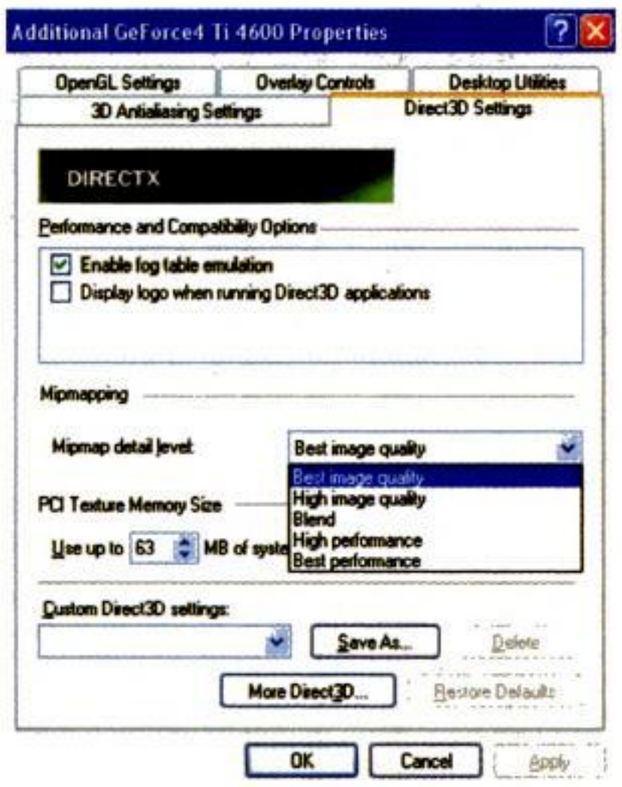
So what caused the scores to creep up? Well, we recently discovered that some system OEMs have been lowering the mipmap level setting in nVidia's control panel in order to achieve higher frame rates. Mipmapping plays low-res textures against high-res textures to speed up performance. For example, when you're 300 virtual feet away from an object, the object is covered with low-res textures—because it would be a bit blurry in real life anyhow. But as you get closer and closer to the object, the object's low-res textures are swapped for progressively higher-res versions. Using low-res textures on faraway objects is a crafty trick, but the technique isn't perfect.

In some games, lowering nVidia's mipmap level setting can result in inordinately fuzzy graphics. High-res textures abruptly switch to low-res textures, and visuals suffer as a result. In most of the *3DMark2001 SE* suite, lowering mipmap levels doesn't make a large performance difference. In Game 4, however, it provides 25 percent more performance because the test relies so heavily on high-res textures. One system vendor believes that lowering mipmap levels doesn't harm visual quality, but we disagree.

In Image A on this page, look at the tree on the lower right and the rock directly behind it. With mipmap levels set to "best image quality" on a GeForce4 Ti 4600, the leaves are crisp and the rocky surface is well-defined. In Image B, with mipmap levels set to "best performance," the same visuals lack definition. Unacceptable!

It's important to note that the vendors do have one point in their favor: Few people have noticed the texturing differences until now. In fact, it takes careful examination of the Game 4 benchmark to see the difference. But once you do side-by-side comparisons, the amount of detail you're missing becomes evident. (Our screenshots don't accurately reveal the blurriness.)

Maximum PC has decided that lowering mipmap levels is equivalent to cranking down resolutions or using 16-bit colors. We will continue to review desktop systems as shipped, but will make careful note of which mipmap settings the vendor applied.



Some system vendors decrease their mipmapping settings at the price of visual quality.

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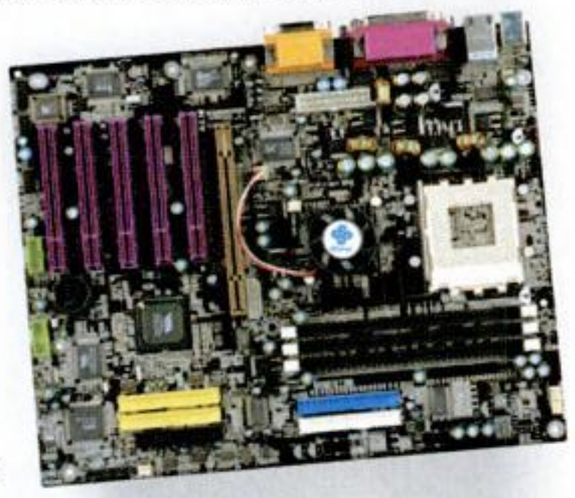
K7V Dragon Ultra Revisited

Let's take a second look at Soyo's Athlon motherboard



When we reviewed Soyo's K7V Dragon Ultra in our June 2002 issue, we found problems that seemed to suggest a memory bandwidth glitch, and promised to retest the board when an updated BIOS was made available.

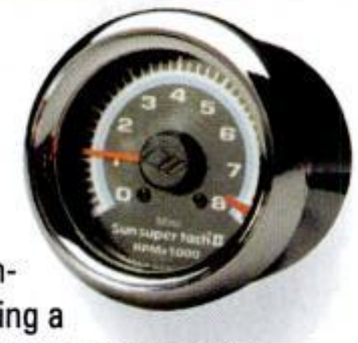
Well, the new BIOS arrived in early July, so we retested the board in the exact same platform that was used for June's review roundup. We're pleased to report that the Dragon Ultra is now posting scores on par with the other VIA KT333-based motherboards we had reviewed. If you haven't updated the BIOS on your K7V Dragon Ultra board, do so immediately. And if our June issue review discouraged you from buying the board, you can now safely reconsider. Jeeves, the benchmarks, please...

That Was Then, This Is Now

BENCHMARKS	Old BIOS	New BIOS
SYSmark2002	177	183
3DMark2001 SE	7891	7783
Quake III Arena	230fps	244fps
SiSoft Sandra 2002 RAM Composite	1948 MB/sec	2021 MB/sec
PCMark2002 CPU	4925	5042
PCMark2002 HD	945	1101

Xoxide PC Tachometer

For PCs that just can't drive 55



If you're the kind of guy or gal who likes primer-painted, big block Chevys, then you'll love Xoxide's PC Tachometer. The company has wired a Sunpro tach with a serial port connection. Using a small Windows plug-in, the tach tracks the CPU utilization of your PC muscle car. The round shape prohibits drive bezel mounting, so you'll need to cut a hole in the front or top of your case. Either way, it's actually pretty mesmerizing to watch the needle peg redline as you fire up your favorite game. $60 for tachometer, $15 for software, **www.xoxide.com**.

Best of the Best

As of August, 2002

Based on final review evaluations, here are our current top picks for each hardware category. Check back next month for updates.

High-end videocard:
Visiontek Xtasy Ti 4600 (GeForce4 Ti 4600)
Budget videocard:
Gainward GeForce4 PowerPack! Ultra/650XP Golden Sample (GeForce4 Ti 4200)
Do-everything videocard:
All-In-Wonder Radeon 8500DV
Soundcard:
Sound Blaster Audigy Platinum
Hard drive:
Western Digital 1200JB
CD-RW drive:
Lite-On 48x
LCD Monitor:
Sharp LL-1820
CRT Monitor:
Sony F520
P4 motherboard:
Iwill P4R533-N
Athlon XP motherboard:
Asus A7V333
Consumer DV camera:
Sony DCR-TRV17
Portable HD-based MP3 player:
Creative Nomad Jukebox 3
Photo printer:
Epson Stylus Photo 1280
Palm PDA:
Sony Clie PEG-N760C
Pocket PC PDA:
Compaq iPAQ 3835
5.1 speakers:
Klipsch Promedia 5.1
4.1 speakers:
Logitech Z-560
2.1 Speakers:
Klipsch Promedia 2.1

Our current gaming favorites: *Warcraft III: Reign of Chaos, Grand Theft Auto 3, Neverwinter Nights, America's Army: Operations*

Time for Spring Cleaning

This month's how-to on keeping a PC spic and span had us all a little more self-conscious about the state of our own rigs. I mean, really, when was the last time we had vacuumed out our interiors or spent some quality time with the Simple Green?

We were a bit embarrassed about what we found...

We had become so used to seeing this trusty dust bunny curled up next to the warmth of the videocard, we had actually given it a name.

Would you believe that for the longest time Johnathan just thought he was losing his eyesight?

Sometimes Gordon gets so caught up in his work, he can't be bothered with the little things.

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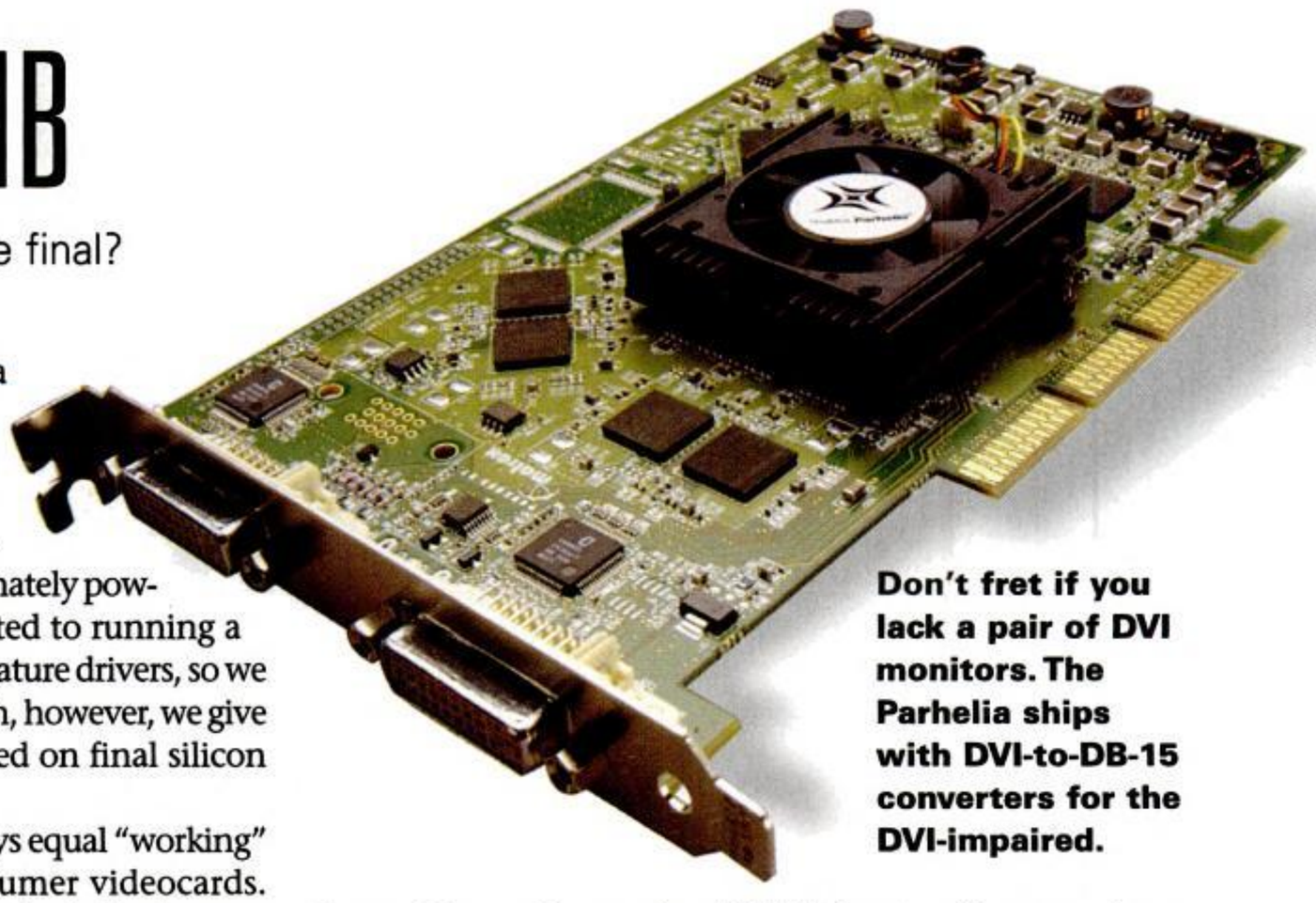
Matrox Parhelia 128MB

Too slow, too glitchy—are you *sure* the drivers are final?



Don't fret if you lack a pair of DVI monitors. The Parhelia ships with DVI-to-DB-15 converters for the DVI-impaired.

In July, we previewed Matrox's Parhelia videocard, a 3D accelerator tuned for ultimate visual quality rather than world-class frame rates. The concept sounded intriguing on paper because most companies' flagship videocards are already inordinately powerful. Our preview testing had been limited to running a small handful of games on extremely immature drivers, so we were unable to pass judgement. This month, however, we give you our official Parhelia referendum based on final silicon and shipping drivers.

Sadly, "shipping" drivers doesn't always equal "working" drivers in the fast-paced world of consumer videocards. When a particular game renders correctly, it looks very good on the Parhelia. But we also found a lot of games that the card choked down like a tainted shot of Jagermeister. In *Quake III Arena*, the card produced beautiful image quality—but in *Grand Theft Auto 3*, it exhibited huge rendering flaws, including large transparent holes in the environment. In *Stronghold*, everything looked kosher—but in *Jedi Outcast* we saw thin white lines between polygons. In *Star Trek: Armada 2*, nary a problem—but *Die Hard: Nakatomi Plaza* was unplayable whenever a weapon was equipped. You get the drift. From our admittedly brief survey, we can say that, as far as game compatibility is concerned, the Parhelia falls squarely between the abysmal Kyro 2 and the original Radeon, which had some driver glitches early in its life.

THE SPECS

Core	220MHz
Memory	275MHz
RAMDAC	Dual 400MHz
Max resolution	2048x1536@85Hz (single screen)

We knew the Parhelia's performance would be slack, but it was actually worse than expected. Although the Parhelia does beat the GeForce4 Ti 4600 when both cards are running 1280x1024/32-bit color with anti-aliasing and anisotropic filtering enabled, *neither* card is able to produce playable frame rates (above 60fps) at this heady quality setting. If you want to play most modern games on the Parhelia with all visual quality settings enabled, you'll have to do so at low resolutions. Quite frankly, we expected better performance from a $400 card that's being released several months after the GeForce4.

Of course, what makes the Parhelia really special is its triple-monitor support. It's wonderful for desktop work, but even more breathtaking in games like *Quake III*, where it provides an immersive, IMAX theater–like experience. That said, we think it takes a special kind of person to plunk down all the cash required for three identical monitors along with the reinforced desk needed for support. Furthermore, we found that 2400x600 was the highest resolution we could use for multiplayer *Quake III* before suffering injurious frame rate lag.

With four DirectX 9 vertex shaders, which support the new Vertex Shader 2.0 spec, the Parhelia seems primed for the future. However, by the end of the year, Matrox will be a generation behind nVidia and ATI in respect to pixel shader support. (Check out page 12 for more info on DX 9 pixel shader requirements.) The upshot for gamers is that the basic Parhelia architecture isn't primed to play DX 9 games. Of course, in its current iteration, the card doesn't have the raw processing power to play any DX 9 game that might be released in 12 to 18 months, so the point is somewhat moot.

Running a 220MHz core and 275MHz memory, the Parhelia lacks horsepower, plain and simple. We're certainly not process technology engineers, but we suspect that a die shrink from 0.15-micron to 0.13-micron would allow Matrox to crank up the accelerator's core clock and bring it in line with the competition. And, of course, with more time under their belts, Matrox's driver engineers will surely eek out faster frame rates from the existing core and address the card's unacceptable visual glitches.

Maximum PC is ready and eager to give a Kick Ass Award to a 3D accelerator that offers best-of-class visual quality—just as long as frame rates can hit 60fps at 1280x1024 in the best first-person shooters. Matrox isn't there yet, and in fact the board we reviewed smacked of "proof of concept" rather than "ready for prime time." But we embrace Matrox's basic message, and we'll give the Parhelia second and third looks as the next-gen videocard scene begins to take shape in the coming months.

—WILL SMITH

MATROX PARHELIA 128MB: BENCHMARKS

	Q3 MPC demo	Jedi Outcast MPC demo	3DMark 2002: SE GAME 2 High	3DMark 2002: SE GAME 4	3DMark Overall
No AA	71.4fps	39.5fps	54.6fps	21.3fps	7355
16x AA	51.7fps	33.7fps	36.9fps	15.5fps	5717
16x AA & anisotropic filtering	43.5fps	33.6fps	32.3fps	9.1fps	4907

All benchmarks were run on our Pentium 4 test beds at 1280x1024/32-bit color. We normally test anti-aliasing at the 2x setting, but the Parhelia doesn't support that setting, so instead we used the proprietary 16x fragment AA. More details on our benchmarking procedure can be found at **www.maximumpc.com**.

MAXIMUMPC VERDICT

Parhelia 128MB
MATROX

DUTCH MASTERS
Excellent visual quality in many games, and the triple monitor support is awesome for both desktop work and gaming.

BOARDWALK CARICATURISTS
Sketchy drivers, low performance at high resolutions.

www.matrox.com
$400

7

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Hypersonic Sonic Boom

One can never have too much memory and hard drive space

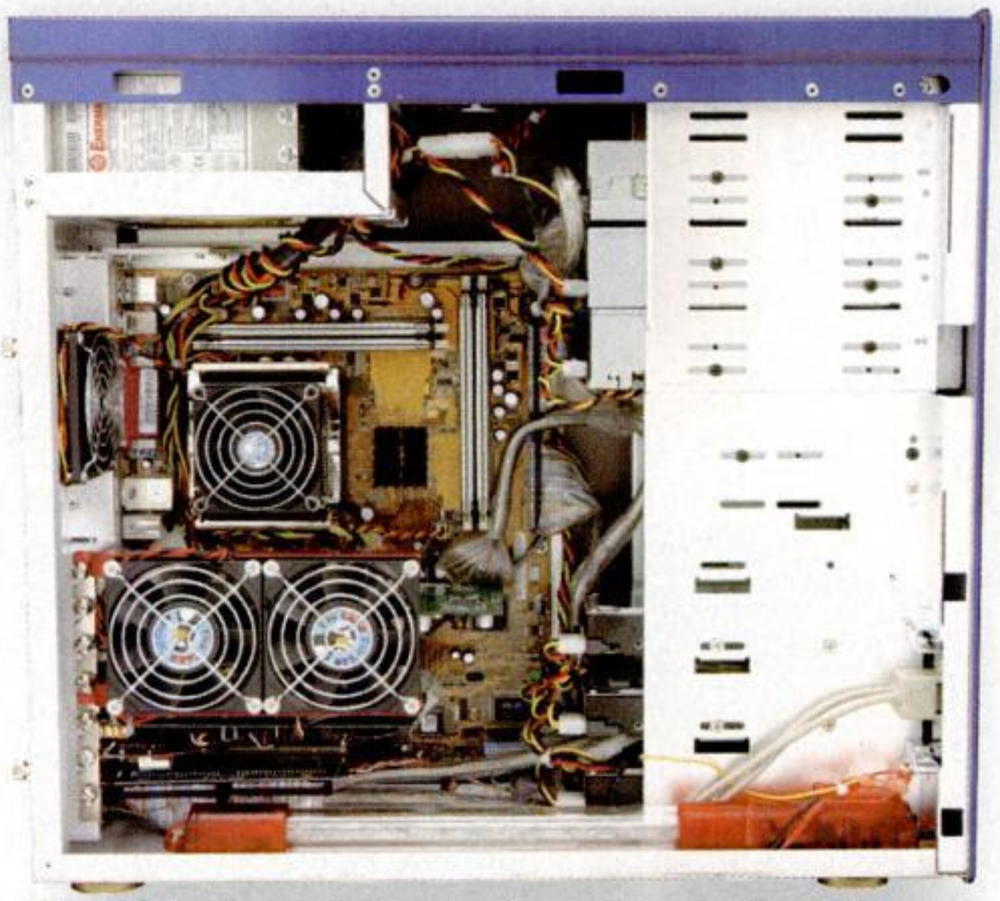
Packed with an almost silly amount of primo components, the Boom is versatile and fast, but falls just short of greatness because of a few flaws.

The first misstep was immediately noticeable upon unpacking the system. We're not sure why Hypersonic didn't color-coordinate the optical drives, because having one beige and two black drives essentially ruins the overall appearance of an otherwise stylish system. The glossy purple paint job is slick, the interior wiring (replete with rounded cables) is swank, and we dig the groovy, sound-sensitive interior light.

In another interesting quirk, Hypersonic threw in two fans to cool the overclocked Visiontek GeForce4 Ti 4600, but aimed them directly at the side panel, away from the card. We contacted the company and were told that testing proved this to be the optimal cooling setup, but we're not convinced. Other than that, though, the Sonic Boom's interior didn't give us much to complain about. While there's little room for additional PCI cards, there are two empty drive bays. Meanwhile, a brawny 550-watt power supply provides plenty of juice for all the upgrades your nerdy heart desires.

Mismatched colors and suspicious cooling aside, there's a lot to love about this system. The nucleus of the Boom is the awesome 2.53GHz Pentium 4 running on a 533MHz frontside bus. And despite the rarity of PC1066 RDRAM, Hypersonic managed to procure a whopping 1GB of it. There are no empty slots for additional memory, but honestly, how many people need more than a gig?

An equally impressive supporting cast backs up the indomitable P4/PC1066 duo. Storage duties are handled by dual 80GB IBM 120GXP drives in a RAID 0 configuration, supplemented by a lone Western Digital 120GB drive with 8MB cache. Optical storage freaks won't be disappointed either, as the Sonic Boom sports DVD-ROM, DVD-R, and CD-RW drives. The GeForce4 Ti 4600 has both video-in and out connectors, and is accompanied by a Pinnacle Studio DV capture card. However, given that the Sonic Boom is billed as a home entertainment rig, we're a bit disappointed by the lack of a TV tuner card.



The Sonic Boom's interior is so tidy, you'd think Felix Unger put it together.

Predictably, all of these premium components led to excellent results in our benchmarks. The Hypersonic set new review-system records in *3DMark2001* and *MusicMatch*, trumping even the mighty Velocity ProMagix reviewed last month. However, the *3DMark2001* Game 4 score was influenced by the fact that Hypersonic set the videocard to run mipmaps at their lowest detail level. It's our policy to benchmark systems as shipped, but it should be noted that when we turned up mipmap detail to its default ("Best Image Quality"), the Game 4 score plummeted to 35.1fps. In most other tests, the Sonic Boom ran neck-and-neck with the fastest systems we've reviewed, except in the Athlon-dominated *Premiere* test.

All in all, the Sonic Boom is a stupendous all-around system with solid performance and a host of top-flight components. Hypersonic has crafted a most compelling machine, and with a little more attention to detail, this rig would kick some serious ass.

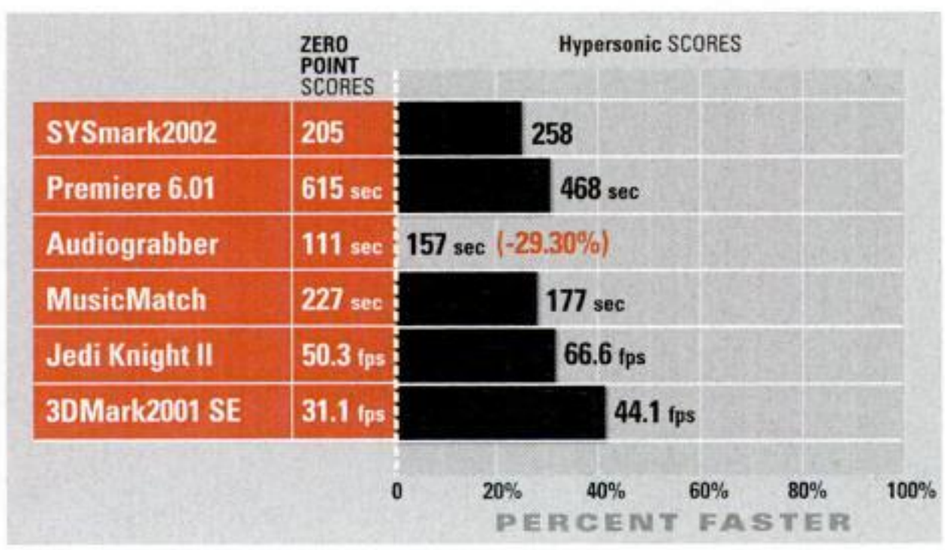
—OMEED CHANDRA

UNDER THE HOOD

THE BRAINS	
CPU	2.53GHz Intel Pentium 4
Mobo	Asus P4T533-C
RAM	1GB PC1066 RDRAM
I/O ports	Four USB 1.1, four USB 2.0, four FireWire, PS/2 mouse, PS/2 keyboard, parallel port, two serial ports, mic input, VGA, DVI, two analog out, digital audio out
LAN	Onboard Intel 10/100Mbps Ethernet
DISPLAY	
Videocard	Visiontek GeForce4 Ti 4600 128MB
Monitor	not reviewed
STORAGE	
Hard drives	Two 80GB IBM 120GXP joined in RAID 0 with a Promise ATA/100 RAID controller, one 120GB Western Digital WD1200JB (8MB cache)
DVD-ROM	Toshiba 16x SD-M1612 DVD-ROM
CD-RW	Teac CD-W540E (40/12/48)
DVD-R	Pioneer DV-R A04 (2x write, 1x rewrite)
AUDIO	
Soundcard	Sound Blaster Audigy Platinum
Speakers	not reviewed
FINE DETAILS	
Case	Reflexxion Series ColorShift ATC-201 w/ Enermax 550W power supply
Fans/extras	Innerworks 15" sound-sensitive fire rod, six 80mm fans.
Mouse	Microsoft Intellimouse Explorer 3.0 USB
Keyboard	Keytronics Lifetime Series PS/2 keyboard
BUNDLE	

Windows XP Professional, Steinberg *Cubasis VST*, Image-Line *Fruityloops 3*, Sonic Foundry *Acid Style 2.0*, Roxio *Easy CD Creator 5 Basic*, Pinnacle *Express*, Pinnacle *Studio DV*, *Veritas DVD Creation Software*, Cyberlink *PowerDVD XP 4.0*, Ulead *Video Studio 4.0 Basic SE*

BOOT: 61 sec. **DOWN: 7 sec.**



Full benchmarking details in the Benchmarks section of MaximumPC.com

MAXIMUMPC VERDICT

Sonic Boom
HYPERSONIC

+ FORD MUSTANG

Chock-full of cutting-edge components, including both DVD-R and CD-RW drives; nifty sound-sensing interior light.

– FORD PINTO

Mismatched optical drive colors, no TV tuner, questionable videocard cooling, relatively pricey.

www.hypersonic-pc.com
$4,667 (w/o monitor or speakers)

9

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Vicious Pentium 4 Limited Edition

Just a few clock cycles short of Kick Ass

Maximum PC receives review systems from all over the U.S. and Canada, but every now and then it's nice to check out the local talent—and the talent doesn't get much more local than Vicious, a small company located just five minutes from our Lab in Brisbane, Calif. Vicious was launched by two former CNET editors who decided to jump the fence and begin selling rigs for hardcore PC gamers. And thus the Pentium 4–powered Limited Edition was conceived.

The case itself—designed by Vicious—isn't as sophisticated as the offerings from Falcon or Voodoo, but its custom cutout logo and red plastic window look great when backlit by three ultra-thin interior lights. And if the boy-gamer aesthetics aren't enough to make your friends jealous, then the EVGA Geforce4 Ti 4600 should make you the hit of the LAN party. This unique card features a special copper "heat pipe" cooler designed to whisk frigid air over the card's memory, top and bottom. That comes in handy, considering that Vicious ordered the card factory-overclocked. Although the core remained at 300MHz, the memory was running at 363MHz (724MHz effectively).

Our review system included a 2.5GHz P4 and 512MB of PC1066 RDRAM sitting atop a Gigabyte Titan 533 motherboard. With its beveled edges and gold-plated northbridge fan, you have to wonder if the Limited Edition is primping for a beauty pageant. Storage duties are handled by two 80GB Maxtor drives running in a RAID 0 config. We had some early concerns about the Maxtors' performance, considering that 8MB cache Western Digitals seem to rule the hard drive roost. But the rig still hit 256 in *SYSmark2002* and 465 seconds in *Premiere*, so it appears that the Maxtors performed on par with the WDs (at least in our limited benchmark runs). The 80GB Maxtors also cost $50 less per drive than the WDs on the open retail market.

Gaming performance was outstanding. You'll get nearly the fastest frame rates this side of Dream Machine 2002, while enjoying aperture-grille splendor on a sweet NEC 19-inch flatscreen CRT. But because this rig is so obviously intended for gamers, we have to wonder why it came with Logitech's Cordless Freedom mouse and keyboard. Not only are these wireless doodads inopportune for gaming, they're also expensive. Vicious should've sent us its Microsoft keyboard and Intellimouse options, and with the money left over, thrown in a Logitech Wingman or two. After all, the system sports a total of six USB 2.0 ports (unfortunately, the two front-mounted ports do not function), so USB game controllers would have been welcome.

Many system builders are including video-capture cards, DVD burners, and numerous other "multimedia" features that gamers will never use, but Vicious went with a no-nonsense approach. The inside of the case is quite clean with the exception of a few messy wires attached to the interior lights. Most of the interior heat is whisked away by a 120mm exhaust fan, and, overall, we'd say that Vicious paid much more attention to cooling than do most system vendors.

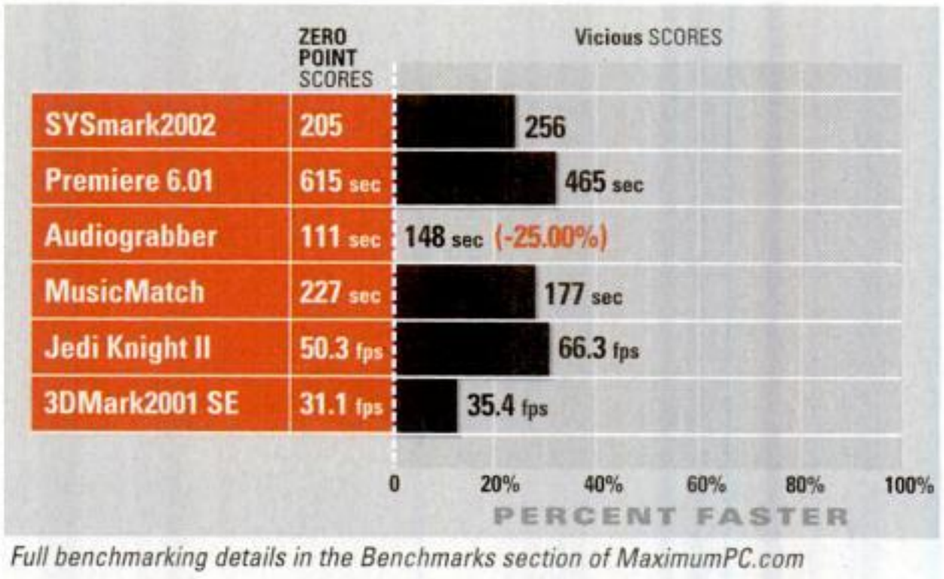
Except for the black plastic on the machine's internal Live Drive, the Limited Edition didn't include any components we'd never seen before, and its benchmark performance, while top-of-the-line solid, wasn't record-setting. Exotic CPU cooling (instead of a stock P4 heatsink) would have looked nice behind the red window. But, all in all, the Limited Edition lays a great foundation for tweaking to come.

—JOHNATHAN D. MCKINNEY

Newcomer Vicious puts out an attractive-looking high-performance box. But will the gamers buy it?

UNDER THE HOOD

THE BRAINS	
CPU	2.53GHz Intel Pentium4
Mobo	Gigabyte Titan 533 GA-8IHXP
RAM	512MB PC1066 RDRAM
I/O ports	One SPDIF in/out, RCA headphone and mic, RCA out left/right channel, optical in/out, four mini-plug speaker outs, two mini-plug mic ins, two game ports, two serial ports, one parallel port, DVI/analog monitor, six USB 2.0 ports (two onboard, four NEC)
LAN	Onboard RTL8100BL NIC 10/100 base-T
DISPLAY	
Videocard	EVGA Geforce4 Ti 4600 128MB
Monitor	19-inch NEC FE950
STORAGE	
Hard drives	Two 80GB Maxtor 80GB D740X-6L
DVD-ROM	Toshiba SD-M1612 16X
CD-RW	Plextor 40/12/48
AUDIO	
Soundcard	Internal Sound Blaster Audigy Platinum with Live! Drive
Speakers	Klipsch 5.1
FINE DETAILS	
Case	Winning PC 6919 HEC (350 watt LT-D power supply)
Fans/extras	three cold cathode lights, one 120mm exhaust fan, two 80mm fans
Mouse	Logitech Cordless Freedom
Keyboard	Logitech Cordless Freedom
BUNDLE	
Cyberlink *PowerDirector 2.0, PowerDVD XP,* Ulead *Video Studio Basic SE, Deus Ex, Cubasis*	
BOOT: 61 sec.	**DOWN: 7 sec.**


ZERO POINT SCORES
Vicious SCORES
SYSmark2002 205 256
Premiere 6.01 615 sec 465 sec
Audiograbber 111 sec 148 sec (-25.00%)
MusicMatch 227 sec 177 sec
Jedi Knight II 50.3 fps 66.3 fps
3DMark2001 SE 31.1 fps 35.4 fps
0 20% 40% 60% 80% 100%
PERCENT FASTER

Full benchmarking details in the Benchmarks section of MaximumPC.com

MAXIMUMPC VERDICT

Vicious
PENTIUM 4 LIMITED EDITION

BAD MEANING GOOD

Creative case design, competent cooling options, six USB 2.0 ports, and great overall value.

BAD MEANING BAD

Small total hard drive capacity, the mouse and keyboard are inappropriate for games, and the system lacks a DVD burner and other new-school amenities.

www.viciouspc.com
$3,500 (including monitor and speakers)

8

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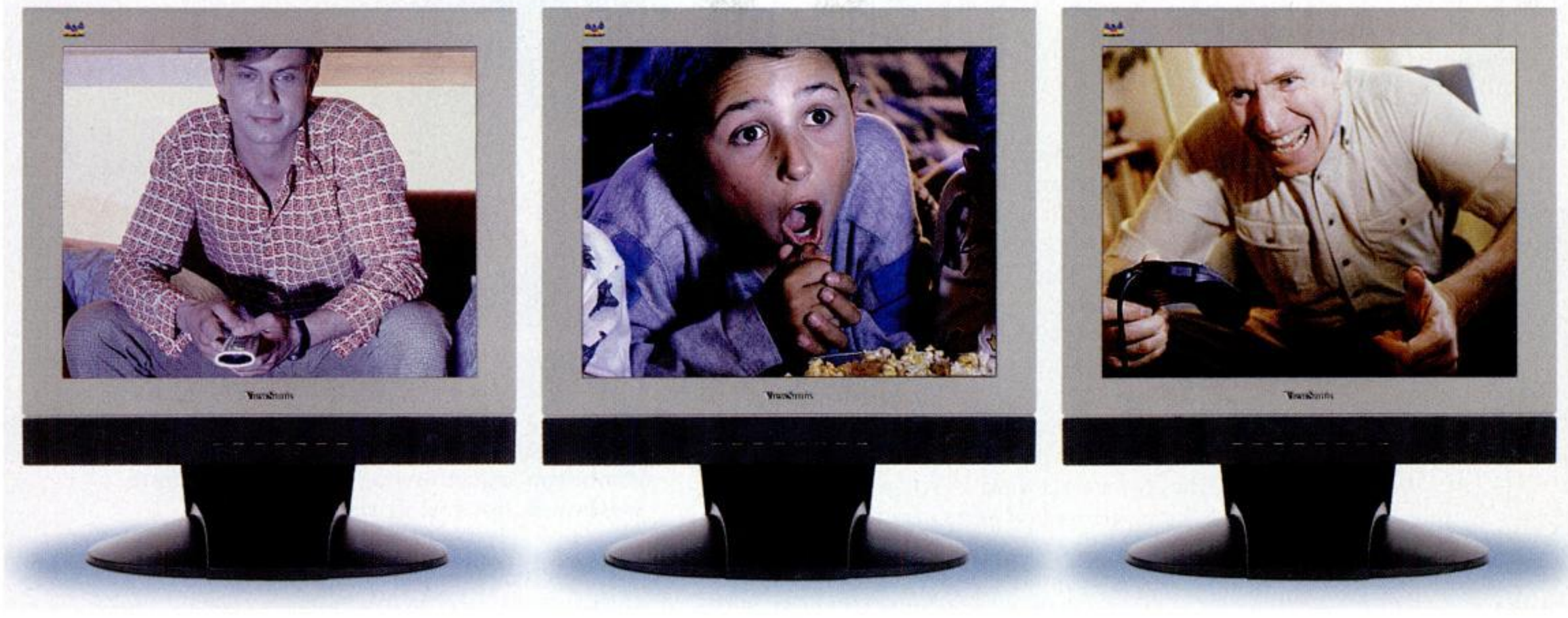
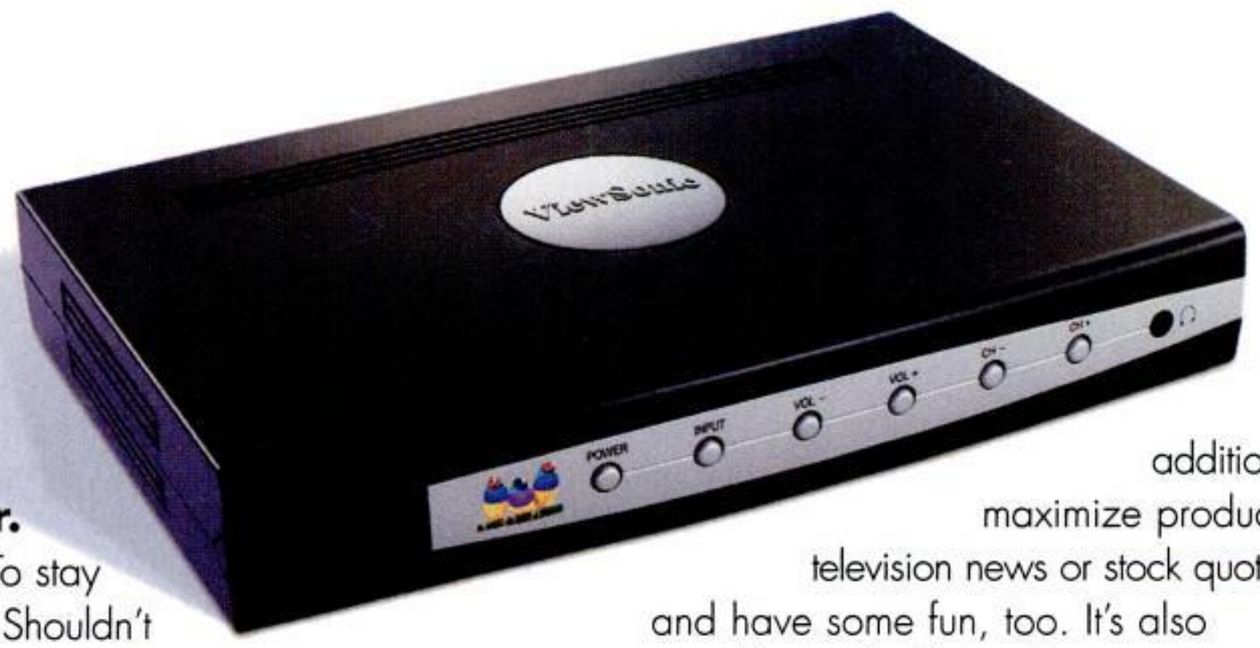
Be all that you can be.



CHANNEL SURFER MOVIE GOER VIDEO GAMER

Without ever leaving your desktop.



NextVision™ 5 from ViewSonic.® It turns your display into a high-resolution multi-media center.

You multitask every day. To stay competitive, you have to. Shouldn't your computer monitor do the same? ViewSonic, the Visual Technologies™ leader, introduces a revolution in desktop productivity and convenience. The new NextVision 5 Video Processor transforms any CRT or LCD monitor into a powerful multi-media viewing center. Connect a cable feed or antenna and with the press of a button, switch from your computer application to full screen, ultra high resolution television viewing (up to 1024x768) via the built-in TV tuner. NextVision 5 also connects DVD players, VCRs and digital cameras. Even plug in your Xbox,® PlayStation2® or Nintendo® for a visual gaming experience like none you've seen before.

Complete with 28-key remote control, NextVision 5 is the perfect desktop addition for those looking to maximize productivity by monitoring television news or stock quotes – and have some fun, too. It's also great for small offices where space is too tight for a separate computer display and television. Setting up NextVision 5 is as easy as a TV. No complicated cards or software to install. Use the included cable to connect the NextVision 5 directly to your monitor (you don't even need a PC). Turn an ordinary desktop into an extraordinary viewing experience. Visit ViewSonic.com today and See the Difference.®

EZ Set-up with RGB in/out, S-Video input, Video Input, Stereo Audio inputs, audio line in and speaker out. Just plug and play.

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PCFX XBRAT Special Edition

Digital Top Ramen for starving students

Designed to make the most of a college dorm room's smurfish dimensions, PCFX's Xbrat Special Edition is tiny enough to sit atop a cramped desk, but comes packed with extras. In addition to the standard complement of PC parts, the "dorm theater" also contains a Hauppauge WinTV card and a Toshiba DVD combo drive, providing TV/FM tuning, video in/out, DVD playback, and CD burning in a single diminutive package. The Special Edition model of the Xbrat eschews a 1.3GHz Duron processor in favor of a 1.4GHz Athlon XP, and ditches integrated nForce graphics for a Gainward GeForce4 Ti 4200 add-in card. But upgrades and extras aside, the rig's benchmark scores range from mediocre to underwhelming—even for a budget machine.

Although the Xbrat is designed for students, it doesn't offer maximum performance in the very content creation and office apps that students use most. In fact, for its low *SYSmark2002* score of 158, the Xbrat deserves to wear a dunce cap and be made to write "I will not run old components" 100 times on the blackboard. This score falls far below our zero-point desktop score of 205, and just eight points ahead of our zero-point notebook. This isn't entirely surprising, as the machine is based on an aging Athlon XP processor, a stifling 256MB of RAM, and a good-but-no-longer-stellar Maxtor hard drive. These lackluster components—parts that haven't been top-shelf since October 2001—drag the Xbrat's performance to the back of today's class.

On the brighter side, students who plan on gaming into the wee hours of the morning should note how the overclocked GeForce4 Ti 4200 turned in fair 3D frame rates. Taking advantage of the sheer overclockability of nVidia's midrange offering, PCFX clocks the videocard with a 315MHz core and 275MHz memory, up from a 250MHz core and 222MHz memory. Scoring 50fps in our *Jedi Outcast* benchmark, the Xbrat is on par with our zero-point system, which uses a GeForce4 Ti 4600. In *3DMark2001* Game 4, the machine muscled its way to 37.8fps in best-performance mode and 28.9fps in best–image quality mode. The machine was sent to us with best-performance mode set as a default, so that's how it was officially benchmarked in our Lab. Just be aware that if you run the Xbrat at this default, your games won't look as impressive.

The Xbrat was configured with good intentions, but PCFX's plans went slightly awry. First, the GeForce4 card is bottlenecked by virtually all other components. Second, the card cooler, while an excellent touch, was poorly positioned—it sits in the already cool bottom of the case, right next to the TV tuner, but far from the sweltering 3D accelerator. Third, the 256MB of RAM, while of the faster CAS2 variety, comes in a dual 128MB configuration. This is necessary to take advantage of the nForce chipset's dual-channel memory architecture, but it also fills all available memory banks on the microATX motherboard, making memory upgrades a wasteful process. We would have preferred a machine configed with 512MB from the get-go.

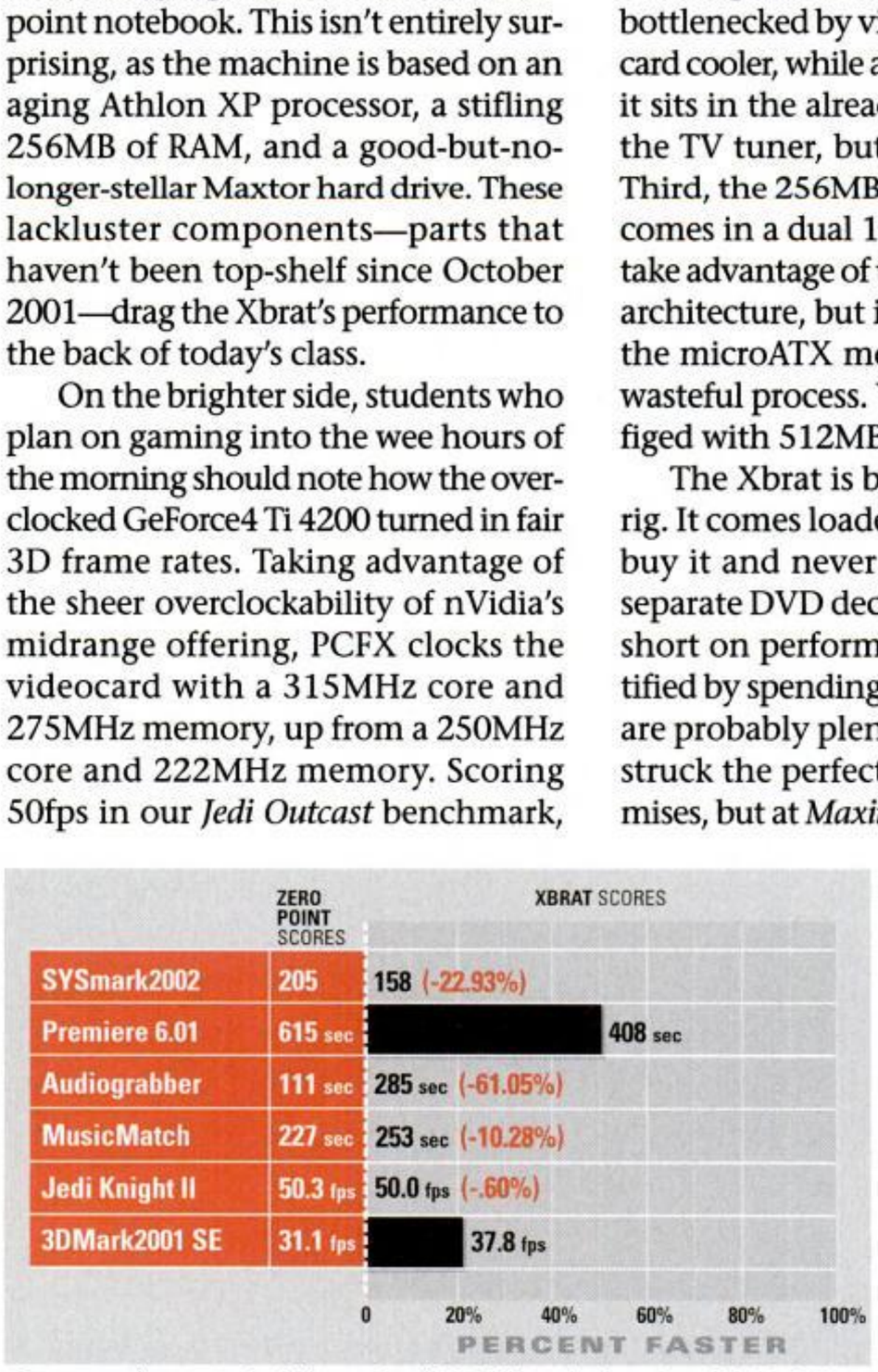
The Xbrat is both more and less than a typical budget rig. It comes loaded with so many features, a dormie could buy it and never give a second thought to purchasing a separate DVD deck and television set. But it's also seriously short on performance, a problem that could only be rectified by spending more money on core components. There are probably plenty of students who will think that PCFX struck the perfect balance between features and compromises, but at *Maximum PC* we'd prefer to spend more money and have it all.

—BRIAN LAM

The XBRAT would be charming nestled inside Manhattan apartments, prison cells, smurf mushroom houses, or hobbit holes.

UNDER THE HOOD

THE BRAINS	
CPU	Athlon XP 1900+ (1.6GHz)
Mobo	Abit NV7m (nVidia nForce 440)
RAM	256MB PC2100 DDR
I/O ports	Four USB1.1, one Serial, one Parallel, three audio 1/8" connectors (line-in, line-out, mic), game port, LAN connector, PS/2 keyboard and mouse. Hauppauge WinTV card: cable in, cable out, S-video in/out, audio 1/8" jack in, audio 1/8" jack out, IR remote connector
LAN	Integrated Realtek 10/100Mbit
DISPLAY	
Videocard	Gainward Geforce4 Ti4200 128MB
TV tuner	Hauppauge WinTV DBX w/FM Radio and IR remote
Monitor	not reviewed
STORAGE	
Hard drives	60GB Maxtor D740X (7200rpm, 2MB cache, ATA/100)
Optical	Toshiba DVD/CD-RW Combo Drive 16/10/40/12
AUDIO	
Soundcard	Integrated nForce Audio Processing Unit
Speakers	Logitech Z-340
FINE DETAILS	
Case	Directron CASPER II A102 Micro ATX and 200 Watt PSU
Fans/extras	60mm case fan, rounded IDE cables, Cyclone Blower card fan
Mouse	MS Optical Mouse
Keyboard	MS Internet Keyboard
BUNDLE	
Windows XP Home, *Wincoder, Winproducer, WinDVD, Serious Sam*	
BOOT: 46 sec.	**DOWN: 16 sec.**


ZERO POINT SCORES
XBRAT SCORES
SYSmark2002 205 158 (-22.93%)
Premiere 6.01 615 sec 408 sec
Audiograbber 111 sec 285 sec (-61.05%)
MusicMatch 227 sec 253 sec (-10.28%)
Jedi Knight II 50.3 fps 50.0 fps (-.60%)
3DMark2001 SE 31.1 fps 37.8 fps
0 20% 40% 60% 80% 100%
PERCENT FASTER

Our zero-point system includes: an Intel D850MV motherboard, a 2GHz P4 CPU, 512MB PC800 RDRAM, a GeForce4 Ti 4600 videocard, and a Western Digital 1000BB hard drive (2MB cache).

MAXIMUMPC VERDICT

XBRAT
PCFX

+ ANIMAL HOUSE
Offers a nice array of A/V extras. Small, cool-looking case.

– VAN WILDER
Except for the OC'd GeForce4, the machine is stacked with compromised components.

www.pcfx.cc
$1,380 (without monitor)

7

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Just a moment ago things were going great. Your figures finally added up, that critical report was done and your MP3s were downloaded. That was then. Now you're looking at a blue screen on a dead machine.

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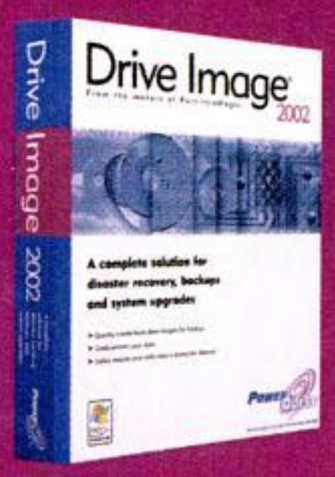

With an easy-to-use Windows® interface, Drive Image 2002 allows you to quickly make a complete copy of your entire system onto a Zip®, Jaz®, CD-R/W, network drive, disk partition or any other suitable storage device. So, when disaster strikes, all your valuable data is ready and waiting for you to put it right back where you left it.

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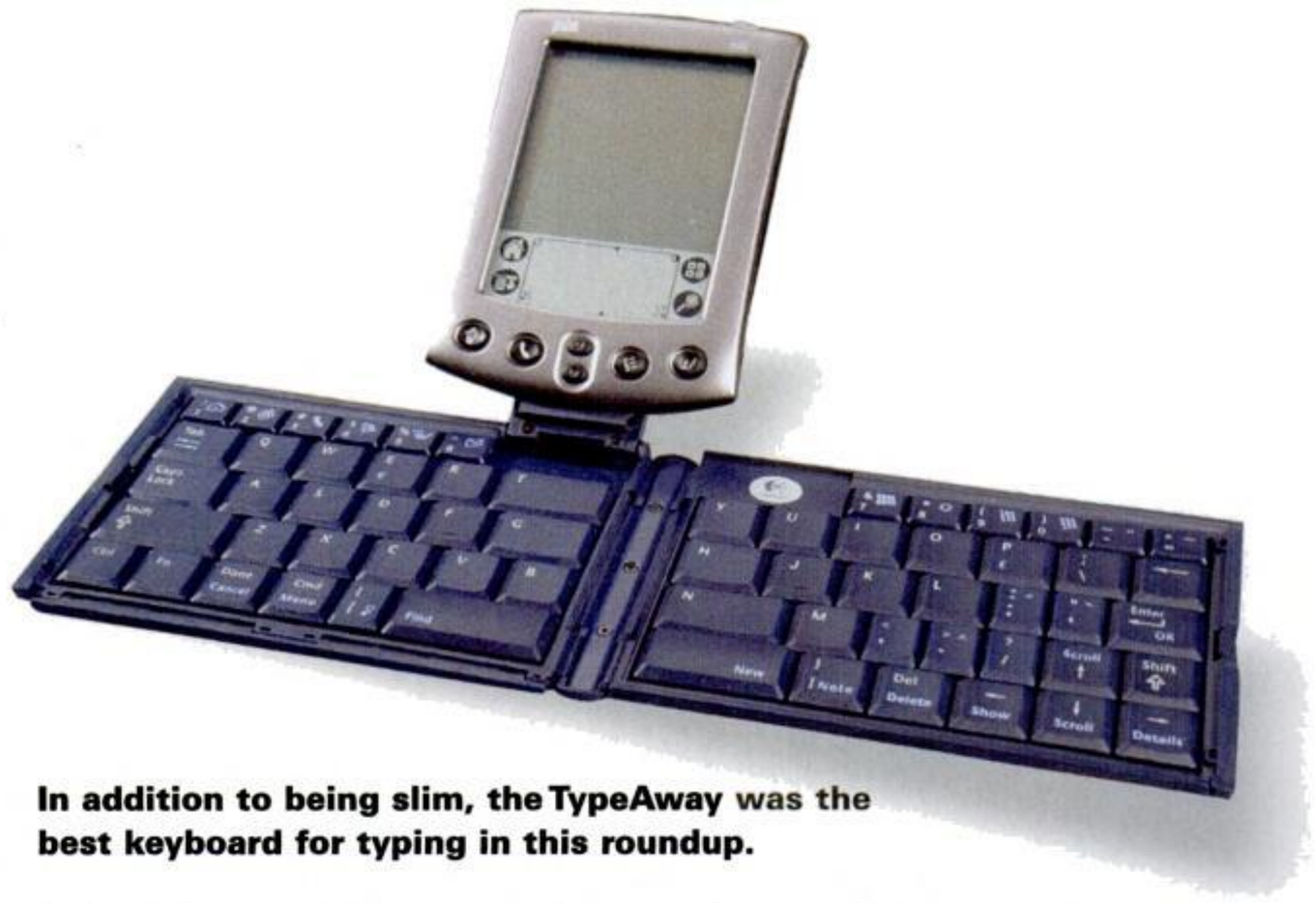
Tiny Keyboard Tussle

Turn your PDA into a legitimate word processor

If you ever have to use Graffiti to enter more than just an address and phone number into your PDA, you may feel the urge to smash your little digital assistant into the nearest concrete wall. *Don't do it*—or at least don't do it until you've tested a portable PDA keyboard. It could be just the ticket to solve your text-entry hell.

—GORDON MAH UNG



In addition to being slim, the TypeAway was the best keyboard for typing in this roundup.

LOGITECH KEYCASE

Logitech's Keycase is a neat concept. Instead of toting around your PDA *next to* a keyboard, why not wrap your PDA *inside* a keyboard? The Keycase is made of a flexible cloth membrane, and its keys are nothing but slightly raised bumps. The keyboard works with any current Palm model that uses the universal cradle, and pulls double duty as a protective sheath. The layout is straight-up Qwerty and includes extra keys to access Palm apps. Sadly, the Keycase is completely frustrating as a typing device because cloth nubbins just don't offer acceptable key response. Not only is there no click, there's no rebound. Of the three keyboards reviewed here, the Keycase also felt the worst in terms of actual ergonomic comfort; and like carpet that keeps bunching up in inconvenient places, the keyboard doesn't sit perfectly flat even when placed on a hard surface. We wanted to love the Keycase because its concept is so damn cool, but in practice, this little magic carpet just doesn't fly.

Verdict: 4, www.logitech.com, $100

The cloth keyboard is annoying at best.

MICRO INNOVATIONS WIRELESS LINK

The Wireless Link could be the last PDA keyboard you ever need purchase. Instead of relying on the proprietary connector of a specific PDA manufacturer, the Wireless Link hooks into a PDA's infrared port. In theory, this makes the keyboard compatible with Palm devices as well as PDAs from Sony, Handspring, and Compaq. Our keyboard came with only Palm OS device drivers, but Micro Innovations promises support for Pocket PC 2002 devices and even hints that support for smart phones might eventually arrive.

The keyboard can be set up in various novel ways. First, you can simply point the keyboard's IR port at your PDA's IR port. With Palm PDAs, this method would ordinarily force you to read text upside down(because Palms have top-mounted IR ports), but the keyboard's driver software can rotate your screen 180 degrees for proper viewing. Second, you can prop your PDA in a bundled cradle that doubles as a flap protector for your screen. The cool thing about the cradle is that it includes a little mirror that's used to deflect your PDA's IR beam onto the keyboard's port. This mode doesn't require any screen rotation. Finally, for Palm V and Palm M5 series PDAs, the keyboard itself can serve as a flap protector. We like this mode the best. It's the least cumbersome and places the PDA at a 90 degree angle, so when its screen is rotated, you get more characters per line (see photo). Check out the company's web site for demos of all these setup options.

While its keys offer good tactile response, the layout itself is a tad small. We think you could eventually get used to the Wireless Link, but it's still a far cry from ThinkOutside's StowAway, the gold standard of PDA keyboards, which unfolds into a full-size, no-excuses layout. But of course, the Wireless Link is much, much smaller. In fact, when clamshelled together as a single unit, a Palm M500/Wireless Link combo is just a bit thicker than the StowAway all by itself. The Wireless Link offers a lot of great features, but you'll definitely want to test it in person before buying it to write your 600-page novel.

Verdict: 8, www.pocketopinc.com, $120

The Wireless Link uses infrared to connect to any Palm OS device. Support for other PDAs is on the way.

LOGITECH TYPEAWAY KEYBOARD

While Logitech's TypeAway doesn't beat ThinkOutside's awesome StowAway, it comes damn close. About the size of a cigarette case, the TypeAway is a simple clamshell with a fold-out attachment for any Palm device that uses the universal connector.

In this roundup, the TypeAway was the most comfortable to type on. Key response almost equaled that of the StowAway, and, of course, the TypeAway is twice as thin as the StowAway. Unfortunately, the TypeAway isn't full-size, so its layout is cramped, and it did take some time getting use to the gap between the two halves of the TypeAway's keyboard. Logitech also shrunk the row of number keys, so you really can't use them without glancing down at the keyboard.

Logitech's keyboard driver is full-featured and lets you set your key repeat rate, delay, and sensitivity, as well as reprogram shortcut keys and commands. If you're a high-speed typist (as if your Palm could keep up), we recommend the StowAway. But if you want a good compromise between size and comfort, the TypeAway is a contender.

Verdict: 8, www.logitech.com, $80

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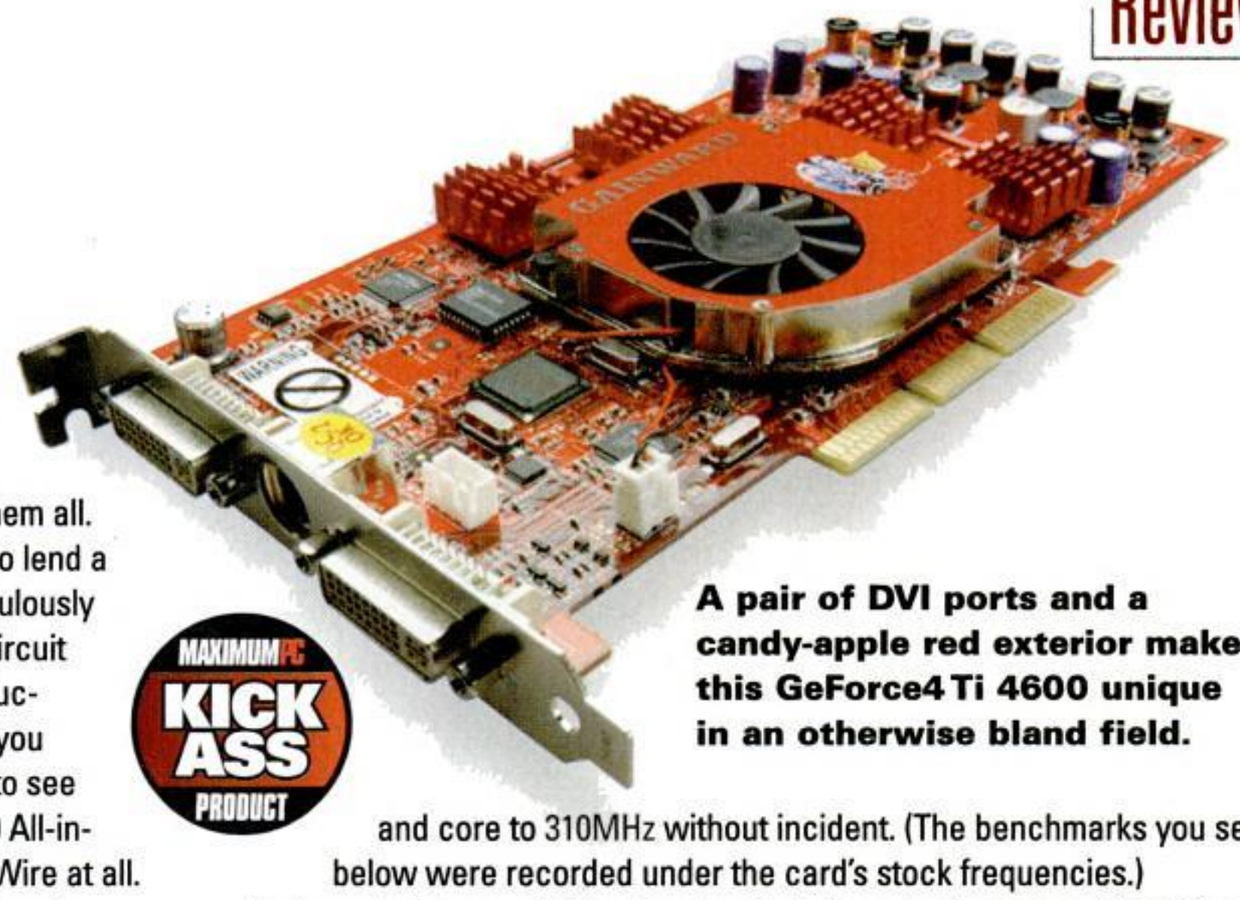
Gainward GeForce4 PowerPack! Ultra/750 XP Golden Sample

GeForce4? Yes! Reference design? Not exactly



A pair of DVI ports and a candy-apple red exterior make this GeForce4 Ti 4600 unique in an otherwise bland field.

Once you've seen one GeForce4 card, you've essentially seen them all. So companies like Gainward must do something—anything—to lend a little personality to their flagship products. For Gainward's ridiculously named Ti 4600 card, "personality" comes in the form of a bright red circuit board, a bundled-in FireWire card, and some rudimentary video production software called *WinProducer* and *WinCoder*. The plan is to give you a complete DV editing solution all in one box. Of course, we'd prefer to see FireWire support directly integrated (as it is with the ATI Radeon 8500 All-in-Wonder), but FireWire on a second add-in card is better than no FireWire at all.

Performance-wise, the Ultra/750 doesn't beat any stock Ti 4600 board equipped with the latest 29.42 drivers. This is a shame, because we were hoping for a little factory-based overclocking when we saw the spiffy red heatsinks stuck on the 325MHz DDR SDRAM. That said, the board comes with its own overclocking utility, and we were able to crank the memory to 340MHz and core to 310MHz without incident. (The benchmarks you see below were recorded under the card's stock frequencies.)

Gainward gives you TV input and output via a single port, and the Ultra/750 is the first nVidia board to enter the Lab with dual-DVI connectors. The bundle includes two DVI-to-VGA adapters for all those folks still running analog LCDs and CRTs. This allows you to use any combination of digital and analog displays and is our preferred configuration for 3D accelerators.

The Ultra/750 XP Golden Sample has a few unique features and an original look. If you're looking to overclock a 4600-based board, this is as good a place as any to start. The thrown-in FireWire card just sweetens the deal.

GAINWARD GEFORCE4 POWERPACK! ULTRA/750 XP GOLDEN SAMPLE BENCHMARKS

	Q3 MPC	JK2 MPC	3DMark 2001: SE Game2 High	3DMark 2001: SE Game 4	3DMark 2001 SE Overall
No AA	102.6fps	49.2fps	89.8fps	32.4fps	10140
2x AA	82.6fps	48.0fps	58.8fps	22.7fps	8133

All tests were run on our Pentium 4 2.0GHz testbeds. Check **www.maximumpc.com** for more details on our testing procedure. Floss daily, or else...

FIREWIRE: Bright red, adorned with memory heatsinks, and includes some nice extras.

PARALLEL: The FireWire support should have been integrated.

—WILL SMITH

MAXIMUM PC VERDICT: 10

$340, www.gainward.com

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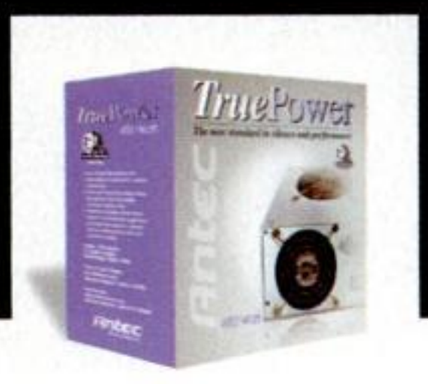

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Yamaha's 44/24/44 CRW-F1

Easy Writer

The internal CRW-F1 pictured here will soon be followed by an external USB 2.0 model, and a dual FireWire/USB 2.0 is a little further down the road.

Having manufactured motorcycles for nearly 50 years now, Yamaha is a company that knows something about tattoos. The bad-boy, rebel spirit has certainly caught on in the optical drive division, where developers cooked up the world's first CD burner that can etch an image onto the unused portion of a compact disc, all without needles or blood. And that's not the only first in the CRW-F1.

Check out the dazzling specs: 24x rewriting—that's double the rewrite speed of the closest competitor. 44x writing, as well as 44x reading and digital audio extraction. An 8MB cache on top of buffer-underrun protection. The CRW-F1 is also the first high-speed optical drive to offer full CAV writing (see sidebar below), and it includes an "Audio Master" recording mode that widens the lands and pits burned into your discs. This allegedly results in reduced jitter levels and provides better audio fidelity.

That's an impressive list of features, and it seems like the CRW-F1 ought to leave tire tracks on the foreheads of all the other manufacturers. But in the Lab, the story was somewhat different.

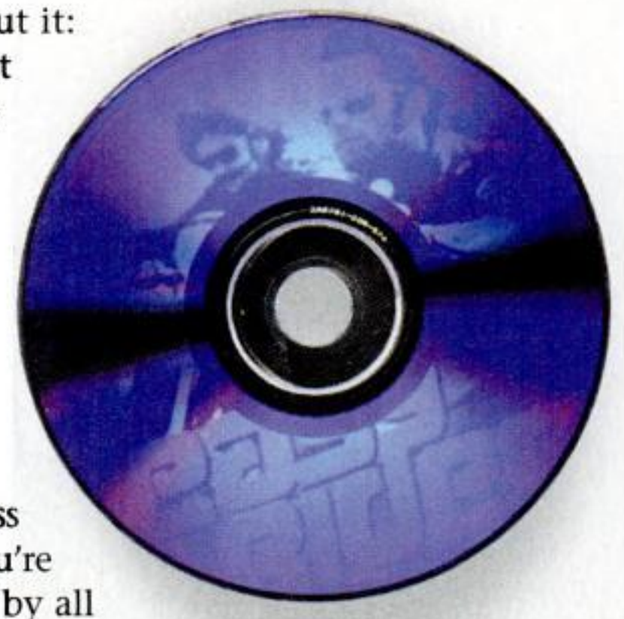
Using three different types of 48x media (Lite-On media, Plextor media, and an unbranded Taiyo Yuden disc), the best burn time we were able to coax from the CRW-F1 was 3:16, writing 647MB of data. Digital audio extraction peaked at around 36x, taking 2:32 to rip our 70-minute CD. These aren't bad numbers, of course, but they do sit behind the curve of the latest 48x drives that write the same amount of data in 2:35 and rip the same CD in a scorching 1:19. Shouldn't the "last burner you'll ever need to buy" (as Yamaha is marketing the CRW-F1) at least whup the drives that came months before it? Unfortunately, the 24x rewriting speed couldn't be tested at press time because the media was still in production—or so we hope. We'll update you on those speeds as soon as we have the CD-RW media at our disposal.

And then there's Disc T@2. This is the vaunted feature that takes advantage of the fact that burned areas of a disc are distinctly lighter in shade than non-burned areas. The CRW-F1 uses precise laser positioning and calibration to render text and graphics on whatever real estate is left over after you're done writing to a disc (this trick can be done only on CD-Rs). Typically, the non-burned space won't amount to much. For example, a disc with 49 minutes of music on it—far below the general audio maximum of 72 minutes—leaves only 3/18 of an inch along the edge of the disc. That's about the width of a big paper clip, and not enough room for, say, track lists or a flowery "Winona Forever" emblem. (I guess we won't be calling it the "Winona Writer.")

Disc T@2 layouts are done within the bundled version of *Nero*. You can type text into the layout window (similar to the CD cover editor included with *Nero*) or import images that can be tweaked with a number of included effects. But the software omits what would have been by far the most efficient and useful feature: the ability to type text on a circular path, or automatically warp images to conform to the curved outer edge of a disc, which is where all the leftover space is! Another serious omission is the ability to preview the area of the disc taken up by your files.

Make no mistake about it: Yamaha's CRW-F1 is a fast drive with some dazzling features. But it's not the top performer in its class, and these dazzling features need time to mature. 24x rewriting is unquestionably awesome, but the media isn't easy to come by, and may not be until early winter when mass production ramps up. If you're a motorbike-riding rebel, by all means, go for it. The rest of us yokels will wait until the Disc T@2 software gets an upgrade and 24x media is as common as tongue piercings and leather jackets.

—LOGAN DECKER



Nice tattoo—but where's the data?

THE BUNDLE

Ahead *Nero*, Ahead *InCD*, Adobe *PhotoDeluxe*, Dantz *Retrospect Express Backup*, *MusicMatch Jukebox*

BENCHMARKS

Average data transfer (MB/sec)	4.7
Average drive rating	32.30x
Random/full-stroke seek (ms)	116/258
Audio extraction (min:sec)	2:32
Data CD burn (min:sec)	3:16
CPU utilization (at 8x)	6%

NOTE: The audio extraction test uses a commercially stamped 70:07 minute audio CD. The data-CD burn test uses the bundled applications to create a 647MB CD-R. For more information on how we benchmark optical drives, look at the Benchmarks section of MaximumPC.com.

FULL CAV—SO WHAT?

Previous drives—including Yamaha's—had to pause burning briefly while they ratcheted up the speed of the drive, an implementation called Zone-CAV or Partial CAV. Yamaha's new drive, however, spins the disc at a constant rate as the laser sweeps toward the outer edges of the disc. The drive doesn't waste time by stopping, nor does it create the linking blocks left behind by Zone-CAV which allegedly reduce compatibility in optical discs.

MAXIMUMPC VERDICT

CRW-F1
YAMAHA

+ MR.ROARKE

The possibility of 24x rewriting is awesome. And Disc T@2 is one cool parlor trick.

– TATTOO

Reading, ripping, and writing speeds all come in well below the latest crop of 48x burners.

www.yamaha.com
$180
9

■ *There are three common methods for tattoo removal: excision, which literally cuts the tattoo out of your skin; dermabrasion, in which the skin is frozen and the tattoo sanded away; and laser surgery, which uses pulses of laser light to break up the pigments. None of the treatments offer spectacular results, often resulting in scarring and/or discoloration.*

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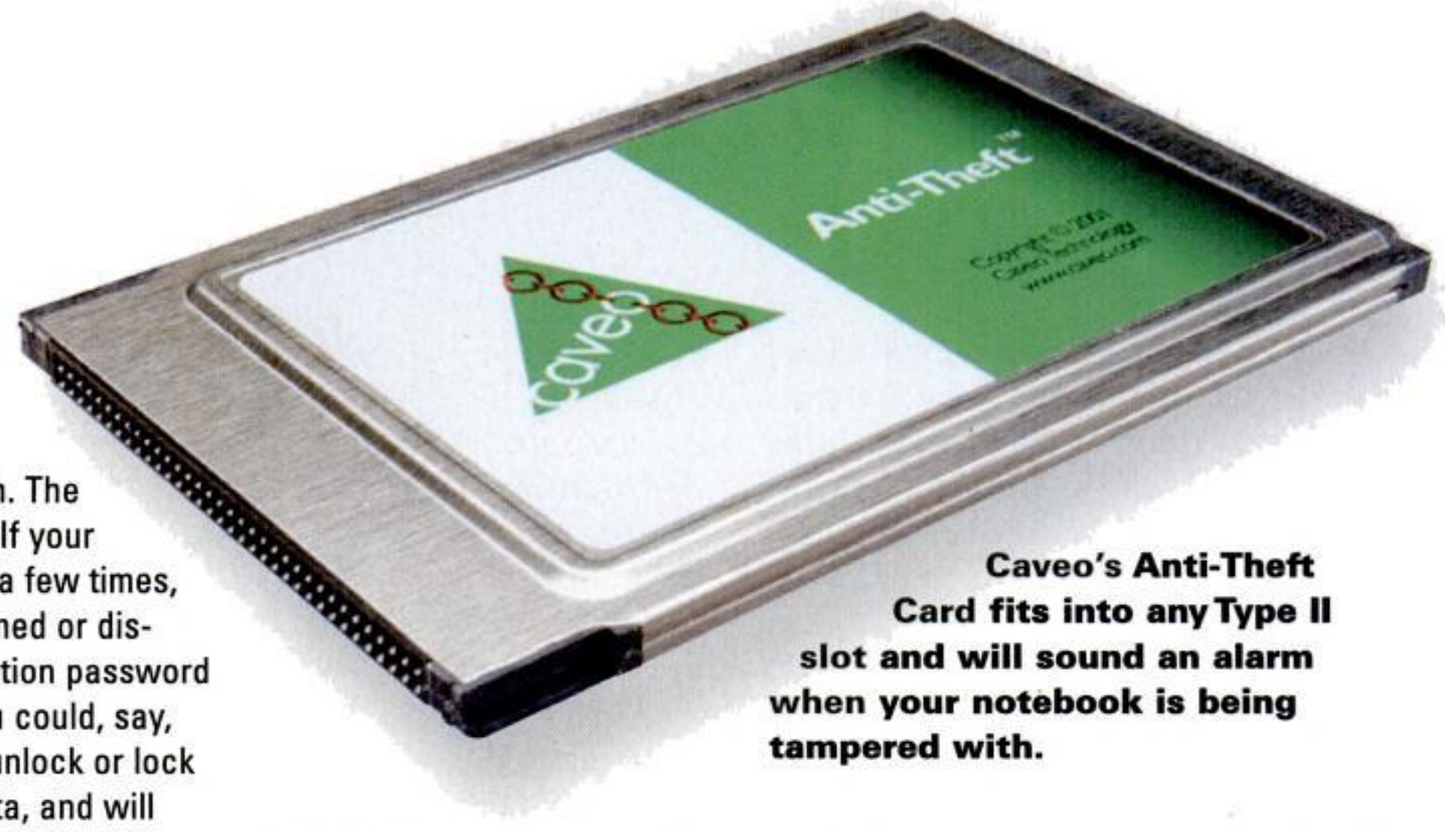
Caveo Anti-Theft PC Card

It's the Clifford Alarm for you notebook PC



Caveo's Anti-Theft Card fits into any Type II slot and will sound an alarm when your notebook is being tampered with.

Securing your notebook computer isn't just a matter of updating your antivirus definitions and running firewall software. The truth is, your notebook PC is more likely to be jacked than hacked. Traditionally, keeping your notebook safe required you to lash it to your desk, but Caveo's Anti-Theft PC Card offers a new approach. The Card fits into any Type II slot and works by sensing motion. If your notebook moves more than a couple feet or is bumped just a few times, a piercing alarm sounds. The Anti-Theft PC Card can be armed or disarmed using a conventional password or, even cooler, a motion password setting of your creation. Sort of like a safe combination, you could, say, tilt your notebook once to the left and twice to the right to unlock or lock it. The software also provides the ability to encrypt your data, and will lock down access to the notebook if the proper password isn't entered.

The strength of the product isn't in the encryption or lock-down, though; it's in the alarm system. We know what you're thinking: Can't a thief simply pop out the card to stop the alarm? No. For one thing, it's unlikely a thief would have time to search for the button to pop out the PC Card, nor would he or she likely know the source of the noise. But just in case, the Anti-Theft Card actually has a battery backup that will keep the shriek going—only not as loud—should the card be removed.

The system's weakness is really in how it's used. In an office environment, a thief with a blaring notebook tucked under his arm would raise suspicions, to say the least. But in a college cafeteria or noisy café, an alarm probably wouldn't even raise eyebrows; our thief would be gone in less time than it takes to whip up a latte. You really need a combination of security devices—a cable lock for the café and an Anti-Theft PC Card for the office.

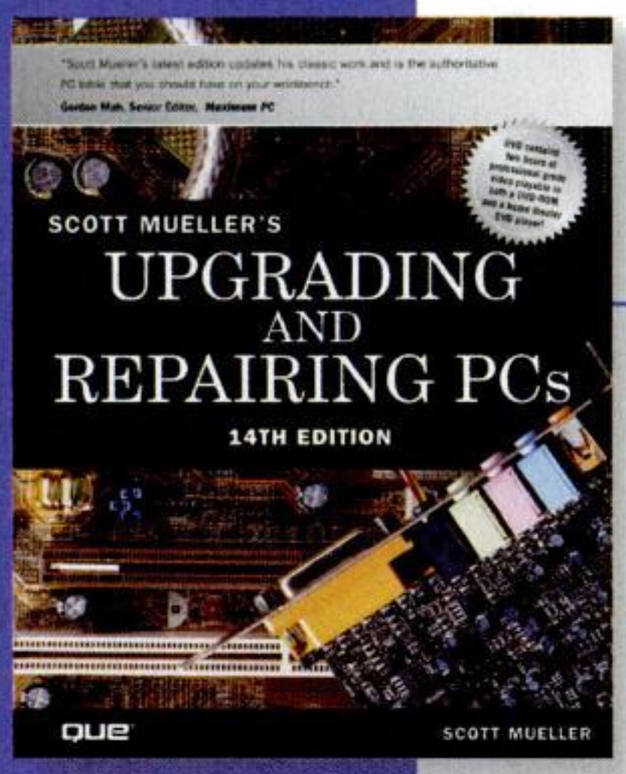
⊕ **RESERVOIR DOGS:** The annoying shriek from the Anti-Theft PC Card will stop most thieves from making off with your precious bundle of joy.

⊖ **FOUR ROOMS**: Just as a tree falling makes no noise when there's no one there to hear it, the Anti-Theft PC Card won't deter anyone if there's no one around to stop the thief.

—GORDON MAH UNG

MAXIMUM PC VERDICT: 8

$100, www.caveo.com



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About Scott

Scott Mueller is president of Mueller Technical Research, an international research and corporate training firm. Since 1982, MTR has specialized in the industry's most in-depth, accurate, and effective corporate PC hardware and technical training seminars, maintaining a client list that includes Fortune 500 companies, the U.S. and foreign governments, major software and hardware corporations, as well as PC enthusiasts and entrepreneurs. His seminars have been presented to several thousands of PC support professionals throughout the world. Scott has developed and presented training courses in all areas of PC hardware and software.

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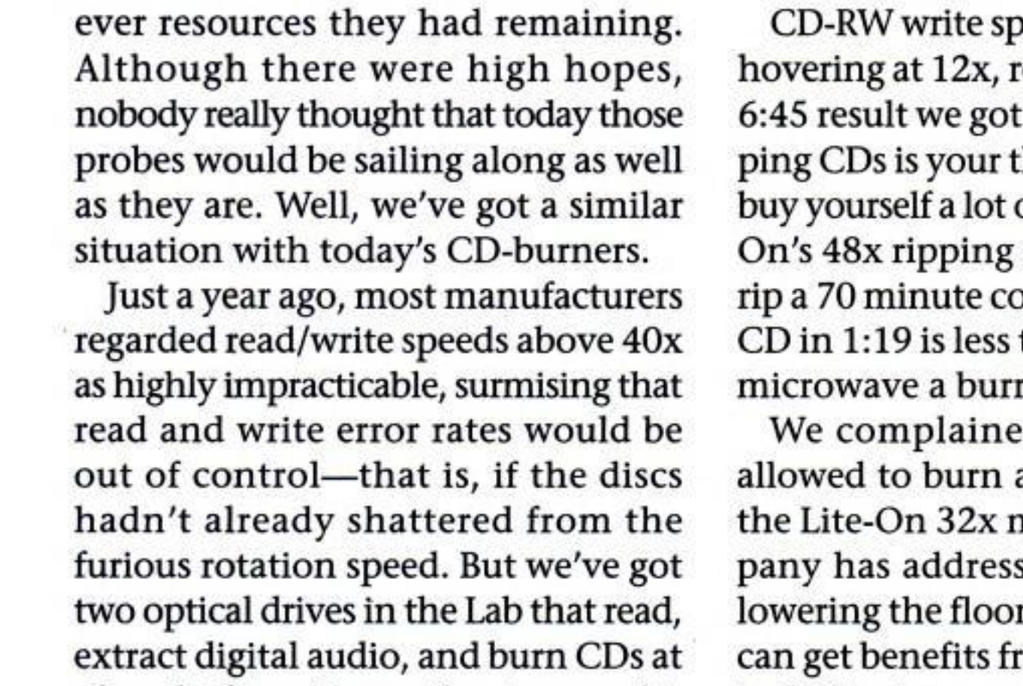
48x Burners Break Orbit!

Lite-On and VisionTek cross over into the final frontier

When the Voyager probes were launched in 1977, they were expected to snap some pics of Jupiter and Saturn, phone home, then drift further outwards on whatever resources they had remaining. Although there were high hopes, nobody really thought that today those probes would be sailing along as well as they are. Well, we've got a similar situation with today's CD-burners.

Just a year ago, most manufacturers regarded read/write speeds above 40x as highly impracticable, surmising that read and write error rates would be out of control—that is, if the discs hadn't already shattered from the furious rotation speed. But we've got two optical drives in the Lab that read, extract digital audio, and burn CDs at a breathtaking 48x—without any multi-laser shenanigans—and we're certain to see faster speeds in the near future. Needless to say, after extensive testing, we're unharmed, and amazed by the results. Have a look...



Lite-On drives aren't getting any prettier, but they sure are getting faster and cheaper.

LITE-ON 48/12/48

THE BUNDLE

Ahead *Nero*,
Ahead *InCD*

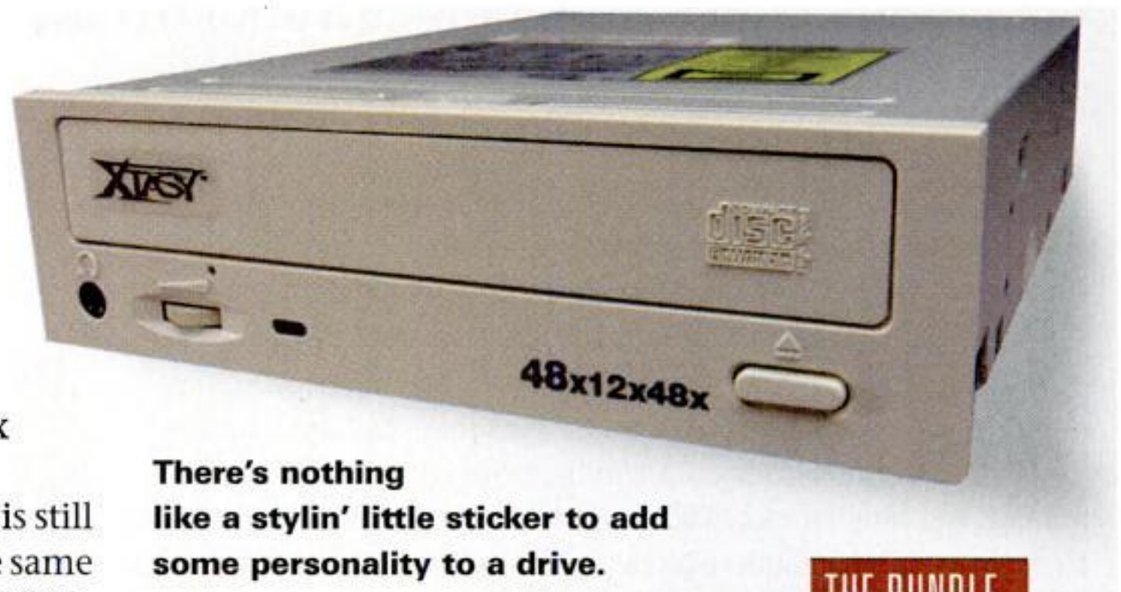
Somewhere in between mass-producing gazillions of optical drives for other companies, Lite-On finds the time to design faster and cheaper drives for hardware freaks like us.

Using the Lite-On 48x and the bundled copy of *Nero*, another record bit the dust when we burned our 647MB test disc in 2:35! That's more than a minute faster than the Lite-On 32x, and a minute and a half faster than the Plextor 40x/*Easy CD Creator* combo. Lite-On managed to exceed our expectations by not only raising the maximum speed of the burning process (which occurs only around the last quarter of the disc), but by also raising the *starting speed*, from 16x in its 32x burner to 22x in its 48x burner.

CD-RW write speed, however, is still hovering at 12x, resulting in the same 6:45 result we got with the 32x. If ripping CDs is your thing, though, you'll buy yourself a lot of time with the Lite-On's 48x ripping speed. To flawlessly rip a 70 minute commercially-pressed CD in 1:19 is less time than it takes to microwave a burrito.

We complained about not being allowed to burn at less than 8x with the Lite-On 32x model, but the company has addressed the problem by lowering the floor to 4x. Finicky users can get benefits from slower burning, including increased compatibility with Iron Age CD players and more reliable CD backups.

Unfortunately, the Lite-On 48x stops far short of wowing us with a big advance in CD-RW write speeds, and that's where we're feeling the pain today.



There's nothing like a stylin' little sticker to add some personality to a drive.

THE BUNDLE

Ahead *Nero*,
Ahead *InCD*

VISIONTEK XTASY 48/12/48

Yes, that's right—VisionTek. The purveyor of fine videocards is now adding optical drives to its repertoire. At first, we were astonished by the physical similarity between the VisionTek Xtasy and the Lite-On 48x. But as the numbers came in—2:35 to burn a 647MB data CD, 1:21 digital audio extraction, 6:45 to write 647MB to a CD-RW—the situation became apparent. It's safe to conclude that we're looking at a repackaged Lite-On 48x drive here.

As far as we're concerned, that's good news. To an extent. One of the most disconcerting aspects of VisionTek's version is the lack of bundled 48x media. Unless you've already got 48x media, you won't be able to take advantage of the drive's true speed. (If you try to use media rated for 40x or below, the SMART-Burn media detection will cap your speed at whatever the media is rated for.) Talk about a downer. Worse yet, no CD-RW media is included whatsoever. Come on, people—48x is cool, but you've got to throw us a friggin' bone. For $70 more than the price of the Lite-On 48x, all you get is a better quickstart guide, a user's manual, and toll-free technical support. Hmm.

Even though it's saddled with a premium price, it's still a great drive that continues to push an aging technology beyond where we thought it could go.

—LOGAN DECKER

BENCHMARKS	LITE-ON	VISIONTEK
Average data transfer (MB/sec)	5.4	5.4
Average drive rating	36.66x	36.60x
Random/full-stroke seek (ms)	92/157	94/161
Audio extraction (min:sec)	1:19	1:21
Data CD burn (min:sec)	2:35	2:35
CPU utilization (at 8x)	10%	10%

The audio extraction test uses a commercially stamped 70:07 minute audio CD. The data-CD burn test uses the bundled applications to create a 647MB CD-R. For more information on how we benchmark optical drives, look at the Benchmarks section of MaximumPC.com.

MAXIMUMPC VERDICT

Lite-On 48125W
LITE-ON

+ VOYAGER (THE SPACECRAFT)
At a paltry $90, Lite-On's fastest drive is also one of the best hardware deals around.

– VOYAGER (THE SHOW)
Rewriteables got no love, with CD-RW write speed still hovering at 12x.

www.liteonit.com
$90
9

MAXIMUMPC VERDICT

Xtasy 48/12/48
VISIONTEK

+ INDEPENDENCE DAY (THE HOLIDAY)
It offers the same performance as the Lite-On 48x, because it is the Lite-On 48x.

– INDEPENDENCE DAY (THE MOVIE)
It's far more expensive than Lite-On's version, without adding much to gloat over.

www.visiontek.com
$160
8

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Cambridge Soundworks Megaworks 510D

Closer, closer—but not close enough

The 510Ds prove Cambridge is serious about reestablishing its rep.

Let's not mince words: After Cambridge Soundworks was bought by Creative Labs, the once-revered speaker company began pushing crap—poorly constructed systems that sounded like budget throwaways. Why even create an unpowered sub? Why even sell a speaker set that can't hit acceptable volume levels? The "new" Cambridge Soundworks posed more questions than solutions.

Fast-forward to today. Cambridge's premium-level 5.1 system for PCs, the Megaworks 510D, addresses some sins of the past. First, the system sounds relatively good for normal day-to-day use. Our music tests revealed a nice tight soundfield (just like you want from multimedia speakers) and the ability to reproduce subtle musical tones, such as the soft chimes that play during the first few bars of the *Star Wars* soundtrack. During gameplay, the 510D positions 3D sound just as well as any other speaker rig we've heard, and provides plenty of punch to let your neighbors know that you just had a near-miss with a rocket launcher.

While overall construction is solid, the satellites are connected to the sub with normal speaker cables on the satellite end, but RCA cables on the subwoofer end. This will prevent most people from upgrading or lengthening cables. The subwoofer contains the standard three analog inputs (front left/front right, rear left/rear right, and center/sub) and a proprietary digital input that works with Sound Blaster cards if you'd rather not run three wires from your PC to your speakers. The satellites are shielded, and each sports a 3.25-inch paper cone speaker, while the sub has an 8-inch woofer.

Our complaint is that the system has trouble handling ultra-low frequencies. Any bassy music makes the sub sound like it's belching. This was especially evident when we listened to hip-hop. At $350, the 510Ds are priced competitively with the Klipsch 5.1s and Logitech Z-560s, but the other speaker rigs are far superior, even though neither includes a digital decoder.

PINK FLOYD: Decent sound at a good price. Plus, you get a digital decoder.

PINK: Poor bass, no power switch, and limited controls are disappointing in an expensive speaker rig.

—WILL SMITH

MAXIMUM PC VERDICT: 6

$350, www.cambridgesoundworks.com

NHT Pro Reference Speakers

Studio-quality audio for flat-output aficionados

Each satellite and the subwoofer includes a discrete amp. This gives great power to each of the speakers, but also means that each will need a power outlet.

We've never tested a pair of speakers that were branded as having reference quality, and we were skeptical that the NHTs could offer much more than the best we've heard from Klipsch and Logitech. But after a few days with these babies, we're convinced that an appreciable difference in sound quality *does* exist—if you're willing to pay an exorbitant price. Be aware that the NHTs are pro-level reference monitors and aren't designed for outputting games and DVD movie tracks. They're intended for use in recording studios, to test things like microphone positioning and reverb so that expensive studio time is never wasted.

As is common with reference systems, you can mix and match different components for an optimal speaker configuration. NHT sent us a pair of M-00 Powered Mini-Monitors (i.e., satellites) with an S-00 Powered Sub and a PVC passive volume control. Each satellite includes a 75W amp, a 4.5-inch paper cone woofer, and a 1-inch soft-dome, fluid-cooled tweeter all wrapped up in a tasty cast aluminum and zinc enclosure. The sub includes its own 125W amp and an 8-inch long-throw woofer. Both the sats and the sub include configuration options for almost any room and offer a special setting to switch the speakers from a near-field setting (suitable for desktop use) to a medium-field setting (more appropriate for wall mounting).

The NHTs' distortion levels were low enough to make a brave man weep. All three enclosures crisply and clearly pumped out our test sounds at all volume ranges, from a nearly inaudible whisper to the earthshaking maximum-volume test. The crossover point was undetectable on our 20Hz-to-22kHz sweep test (unless we placed our hands on the sub to actually *feel* the crossover point).

The NHTs are amazing, but they still sound "flatter" than speakers designed for use in your living room. Granted, this is the case with all top-notch reference systems. If you like to feel the punch of bass when you fire a machine gun, these speakers probably aren't for you. Instead of tuning their response for certain frequency sounds—such as rocket explosions and howitzer fire—the NHT Pros reproduce audio with no coloration whatsoever.

Calibrating the NHTs for your listening environment isn't a simple task, and they cost as much as many home theater–quality 5.1 rigs. But if you're looking to set up a home recording studio, they're wholly appropriate.

THE RAMONES: Reference quality sound reproduction for the true audiophile.

JIVE BUNNY AND THE MASTERMIXERS: The NTH Pros are three times as expensive as a 5.1 speaker rig and a real pain to configure.

—WILL SMITH

MAXIMUM PC VERDICT: 9

$1,550 ($700 subwoofer, $350 per satellite, $150 for PVC), www.nhthifi.com

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Warcraft III: Reign of Chaos

Realtime role-playing: When gaming genres collide

Blizzard has earned a reputation for developing high-quality, extended-play strategy games, and in that genre it's been the studio to beat—especially after the runaway success of *Starcraft*. But how has the vaunted game developer reacted to fashion trends, the abundance of RPG and adventure elements in what used to be pure realtime strategy titles? The answer is the long-awaited *Warcraft III*, which incorporates new features and dynamics into the traditional RTS genre, but with somewhat mixed results.

Warcraft III—like *Warcraft II* and *Starcraft* before it—comes complete with trademark Blizzard storytelling. A thick manual is packed with background detail, prefacing the story of a menace that threatens the entire world. In a nicely explained development, the Humans and Orcs, once bitter enemies, are now grudging allies, and must join forces to combat the new evil. The single-player game is strongly reminiscent of *Starcraft*, insomuch that you must play through four separate campaigns—one as each race—to learn the idiosyncrasies of each group's distinctive building and fighting methods. Blizzard's signature, high-quality CG cutscenes are present, and they're better than ever. *Warcraft III* also has a plethora of in-engine cutscenes, which are interesting at first but quickly grow tiresome. In fact, if you sit through all of them—many of which require a "level" to load—you'll spend easily a third of your game time watching instead of playing.

Blizzard aficionados will immediately notice a reduced, focused sense of scale. Gone are Zergling rushes, massive fleets of aircraft, and row upon row of Marine-filled bunkers. Instead, units are more flexible and more powerful, with both passive and active abilities to choose from. Additionally, you're now privy to "hero" units (up to three per race) that not only increase their abilities RPG-style, but can also carry up to six pieces of equipment to further enhance their power. Equipment is gained not from other players, but from "neutral" monsters that inhabit the map, usually guarding key resources.

Warcraft III also borrows heavily from *Starcraft's* gameplay dynamics. No "duplicate unit but with different graphics" here—each race has a unique style, along with units that reflect and reinforce these styles. Night Elves' buildings, for example, are huge trees that can be uprooted and moved around, while the Undead can't develop on pristine land—they need to extend the Blight, a la *Starcraft's* "Creep." The "hotkey monkey" management from previous titles hasn't vanished, and you'll be using most of your keyboard most of the time.

Graphically, Blizzard has made a graceful move to 3D. Chunky, exaggerated models are mated with butter-smooth animation and crisp, brightly colored skins. The landscape and architecture follows suit, with bulky, detailed, distinctive structures and clear, bright tex-

When Orcs raze and pillage an area you can practically feel the heat on your face, courtesy of *Warcraft III's* tight 3D camera work.

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turing. (This theme stands in sharp contrast to the game's backstory, which is unusually grim.) It's a shame the camera's pan and zoom range is so limited. Zoom movement goes from ground level to about 50 virtual feet up, with 90-degree left and right snap-back rotation. Coupled with the huge, non-toggleable UI, you'll be struggling to see what's going on much of the time. In a nod to the multiplayer requirements, increasing the resolution (even to 1600x1200) only improves the unit detail and lighting; your field of view remains the same. On the up side, any PC made in the last 18 months should run the game fast and smooth at the default settings. Cranking all the settings up to max didn't make a 1.3GHz Athlon with a 64MB GeForce3 Ti 500 miss a beat.

Multiplayer is handled entirely through Battle.net (no direct IP-to-IP play here, folks, though you can LAN it just fine), and everyone will need his own CD to play. Initially, the balance between the races seems to be a bit out of whack (the Night Elves' über unit in particular), but based on Blizzard's track record, we're confident that it's far more finely tuned than it first appears. The lower unit cap keeps games manageable even on a 56K modem, and the multiplayer maps are both varied and interesting. *Warcraft III* also includes the level editor on the CD, so expect plenty of user-made skirmish action in the future.

At first glance, the game is both entirely familiar and entirely different. With unique, varied races, hardcore RTS strategists will have gameplay depths to plumb for a long time to come—but it remains to be seen how smoothly the *non*-RTS elements (heroes, neutrals, extra gear) will be incorporated by the hardcore faction, if at all. Meanwhile, non-RTS aficionados will enjoy the RPG-like gameplay—but the limited viewpoint and unwieldy controls will be off-putting. *Warcraft III* is a damned solid game, and while it's not as instantly compelling as previous Blizzard titles, we're confident we'll be playing it for a long time to come.

—BILL MCCLENDON

MAXIMUMPC VERDICT

Warcraft III: Reign of Chaos
BLIZZARD

+ ZUG ZUG

Crisp, beautiful graphics; top-notch storytelling; distinct and balanced races; accessible and flexible level editor.

– JOB'S DONE

Tank-slit view window; extremely limited camera; awkward use of special abilities; stunningly long and frequent cutscenes.

www.blizzard.com
$50
8

A powerful world editor ships with *Warcraft III*, making it easy to build maps that look like a hot tub.

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Neverwinter Nights

Revenge of the geeks

As a dungeon master, you're a mini god, able to sic a roomful of angry dragons (who also happen to hate *each other*) on a party of unwary online adventurers.

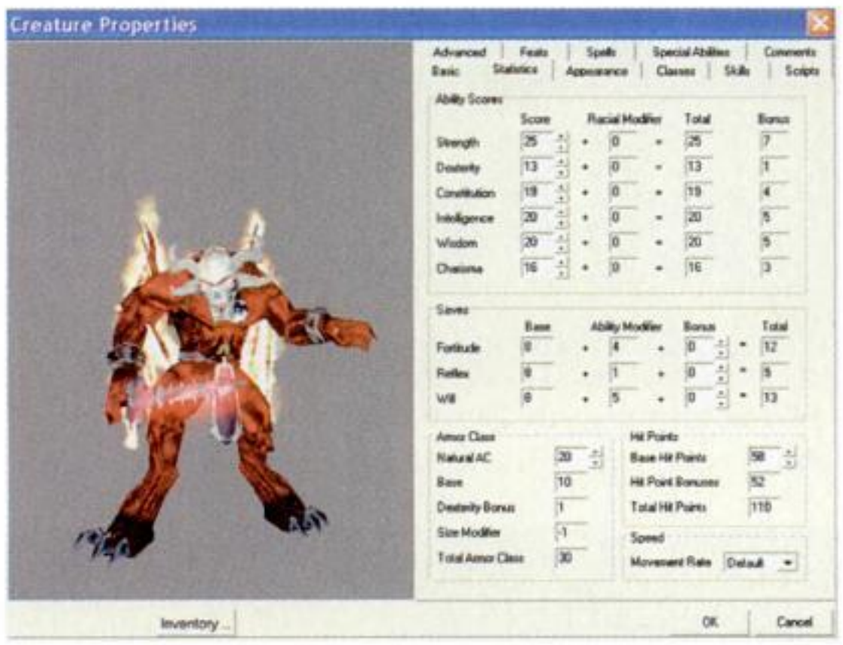
There are a few easy ways to tell whether you're a geek: If you've ever formulated and articulated an opinion on tribbles; if you can quote large swaths of *Monty Python and the Holy Grail* from memory; and if you know what an Umber Hulk is. If you not only know what an Umber Hulk is, but quietly thrill at its smack-on representation in a new computer game, then you are deep into über-geek territory and thus beyond all hope or redemption.

That's the kind of reaction *Neverwinter Nights* inspires. The product box should bear one of those star stickers saying, "Made *by* D&D geeks, *for* D&D geeks!" For a long time we've been told that BioWare's follow-up to its smashing *Baldur's Gate*–engine games would be the be-all, end-all, you'll-never-need-another Dungeons & Dragons game. *This* is the game that would finally bring a true pen-and-paper role-playing experience to the computer for the first time.

Well, does it?

Does an Astral Blade do 1d8 damage?

The single feature that will keep *Neverwinter Nights* on hard drives for a long time is the *Aurora Toolset*. All the tools for creating complete, complex adventures are here, from making the dungeons to placing traps, triggers, monsters, NPCs, and scripting. There have been computer RPG editors before (most recently *Morrowind*), but few so comprehensive and user-friendly.



The *Aurora Toolset* gives you utter control of every single aspect of game creation, from the player right down to editing stats and equipment for each monster.

While the editor holds the promise of infinite downloadable adventures, it's the multiplayer component that breaks new ground. The most appealing element of pen-and-paper role-playing was always the human factor, with groups of people led through an adventure by a dungeon master. Good online RPGs and massively multiplayer RPGs can capture the cooperative adventuring, but until now none have captured the dynamic element added by a dungeon master.

Neverwinter Nights not only does it, but does it brilliantly. A dungeon master can begin a session using the main campaign or an adventure of his own creation. Within that adventure, he completely controls the environment, adding or subtracting objects, monsters, traps, or NPCs; healing or killing creatures; awarding items and experience to players; and even taking complete control of creatures, all with a remarkably simple yet powerful set of tools. Adventurers can play with or without a DM, in public or password-protecting sessions found via the integrated server browser.

The real surprise, however, is the single-player campaign, which many assumed would be minor compared with previous BioWare games. In fact, the campaign game is a vast, intricate, and hugely satisfying 50-hour-plus adventure. The scripting is very good, although it has the same mad flood of text featured in all of BioWare's titles. The text-box writer has a raging case of logorrhea, taking four boxes to say what can usually be said in one. Still, it's a terrific campaign that measures up to the standards set by *Baldur's Gate*.

Since BioWare has made state-of-the-art D&D games for years now, it's almost superfluous to point out that the interface is bulletproof. All controls are distilled into a radial popup menu and a quick access bar, making functions easy to access even in battle. You can create one custom character, then hire henchmen along the way. If there is a single flaw in the whole package, it's that henchmen are handled completely by AI and can be given potions and general tactical orders by only the main character. A true party-based game would have been preferable.

As for complaints, however, that's about it. *Neverwinter Nights* was supposed to be the truest representation of conventional role-playing for the PC. It has turned out to be all it promised, which doesn't happen very often.

—THOMAS L. MCDONALD

MAXIMUMPC VERDICT

Neverwinter Nights
BIOWARE

+ LETTERMAN

The first implementation of the dungeon master role for multiplayer games. A strong, long solo campaign and a flawless interface.

– LENO

Minimal control over "henchmen" keeps it from being a true party-based game. The graphics are good, but not the best we've seen this year. The campaign isn't as difficult as previous BioWare RPGs. (Possibly a plus for some.)

www.neverwinternights.com
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36.7GB	10,000rpm	ST336706LW	4mb	$252
36.7GB	15,000rpm	ST336752LW	8mb	$395
73.4GB	10,000rpm	ST373405LW	★ 4mb	$547
181GB	7,200rpm	ST1181677LWV	16mb	$1336
I B M				
18.3GB	10,000rpm	07N6350	4mb	$169
18.4GB	15,000rpm	07N6800	4mb	$238
36.7GB	10,000rpm	07N6340	★ 4mb	$239
36.7GB	15,000rpm	07N6801	4mb	$381
Hitachi				
18.4GB	10,000rpm	DK32DJ-18MW	4mb	$175
36.9GB	10,000rpm	DK32DJ-36MW	4mb	$279
73.9GB	10,000rpm	DK32DJ-72MW	4mb	$579

Ultra320 Drives require Adaptec's Ultra320 Controller to achieve full performance - A39320D $259

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Buslink	60GB	7200rpm	FW6072E	$190
Buslink	80GB	7200rpm	FW8072E	$238
Buslink	100GB	7200rpm	FW10072W	$285
Buslink	120GB	7200rpm	FW12072W	$313
Maxtor	80GB	5400rpm	X01FWRA080	$212
Maxtor	80GB	7200rpm	Y01FWRA080	$242
Maxtor	160GB	5400rpm	X01FWRA160	$347
QPS	60GB	7200rpm	QPM3HD72F60L	$212
QPS	80GB	7200rpm	QPM3HD72F80L	$235
QPS	100GB	7200rpm	M3HD72F100L	$338
Firewire CDRW Drives				
QPS	32x10x40		CRW321040FL	$187
QPS	40x12x48		CRW401240FL	$222
Yamaha	24x10x40		CRW3200FXZ	$256
Iomega	40x12x48		32359	$211
Firewire DVD Drives				
Addonics	8X DVD/24X		DVD8X24FW	$293
LaCie	DVD-R/RW & CDRW		300164	$468

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Viewsonic	17"	E70FB2	1280 x 1024 - .21	$175
Viewsonic	17"	G70FMB	1280 x 1024 - .23	$210
Viewsonic	19"	E90FB	1600 x 1200 - .21	$262
Viewsonic	19"	G90MB	1600 x 1200 - .22	$340
Viewsonic	15"	VG150B	1024 x 768 LCD Flat	$406
Viewsonic	17"	VE170B	1280 x 1024 LCD Flat	$704
Removable Drives				
Mitsumi 1.44mb Floppy				$17
Teac or Sony 1.44mb Floppy				$21
Iomega 100/250MB Zip IDE				$79/$105
SPEAKERS				
Creative Labs				
Slim500, 3 Piece Satellite			29W	$40
INSPIRE2600, 2.1 Slim Series			19W	$52
INSPIRE5300, 6 Piece Desk Theatre 5.1			48W	$83
INSPIRE5700, 6 Piece Digital 5.1			79W	$242
Sonigistix Monsoon Flat Panel Speakers				
MH505, 3 Piece			51W	$142
MM1000, 3 Piece			50W	$147
MM2000, 5 Piece			340W	$220

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24x10x40	IDE	BenQ 2410A	$64	$104
24x10x40	IDE	Plextor PXW2410TA/SW	$132	$147
24x10x40	IDE	Yamaha CRW3200EZ	$130	$170
32x10x40	IDE	BenQ 3210A	$61	$101
32x10x40	IDE	GoldStar GCE8320BI	$70	$110
32x10x40	IDE	Sony CRX185A1/C1	$118	$158
32x10x40	IDE	MSI MS8332	$59	$99
32x12x40	IDE	Lite-On LTR32123	$62	$102
32x12x48	IDE	Pacific Digital U-30117	$78	$118
40x12x48	IDE	Lite-On LTR40125S	$72	$112
40x12x40	IDE	Plextor PXW4012TA/SW	$145	$160
40x12x48	IDE	Teac CDW540E/KIT	$94	$134
40x12x48	IDE	BenQ 4012P	$70	$110
40x12x48	IDE	TDK VeloCD	$121	$161
40x12x48	IDE	Sony CRX195A1	$121	$161
40x16x48	IDE	Pacific Digital U-30133	$69	$109
48x12x48	IDE	Pacific Digital U-30127	$85	$125
48x12x48	IDE	Lite-On LTR48125S	$90	$130
48x16x48	IDE	BenQ 4816P	$93	$133
12x10x32	SCSI	Plextor PXW1210TS/SW	$215	$255
24x10x40	SCSI	Yamaha CRW3200SZ	$233	$273
DVD Drives				
16x/48x	IDE	Toshiba SDM1612TA	$75	$100
16x/40x	IDE	Pacific Digital U-30115	$59	$84
16x/40x	IDE	Pioneer DVD Slot DVD106	$69	$94
16x/40x	IDE	BenQ DVD1648A	$80	$105
10x/40x	SCSI	Pioneer DVD305S	$104	$129
CD-ROM Drives				
52x	IDE	Lite-On LTN525	$35	$60
52x	IDE	Creative Labs BLASTER52X	$35	$60
52x	IDE	Sony CDU5211	$40	$65
56x	IDE	BTC G621D	$34	$59
40x	SCSI	Plextor PX40TSI	$89	$114

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QPS	60GB	5400rpm	USB2.0	$205
Buslink	40GB	7200rpm	USB2.0	$173
Buslink	60GB	7200rpm	USB2.0	$190
Buslink	80GB	7200rpm	USB2.0	$238
Buslink	100GB	7200rpm	USB2.0	$334
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Iomega	100MB Zip Ext USB Drive 31197			$89
Iomega	250MB Zip Ext USB Drive 31310			$142
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Iomega	24x10x40 USB 2.0 CD-RW			$181
Yamaha	24x10x40 2.0 CD-RW			$196
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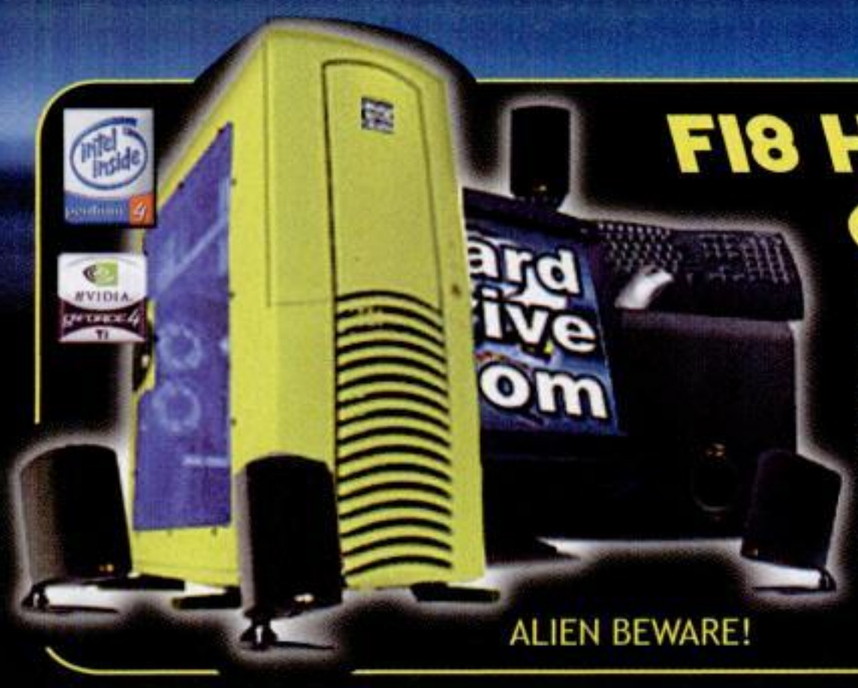

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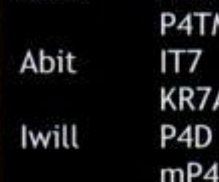

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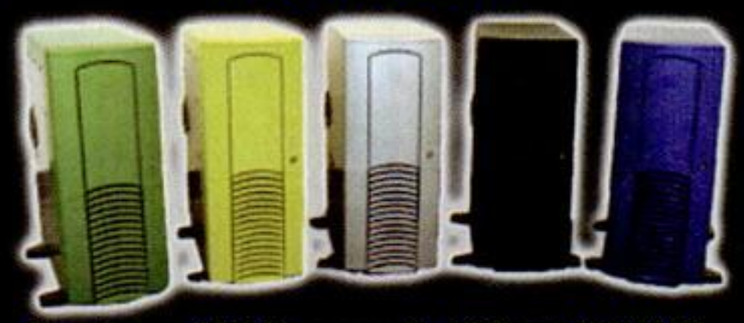

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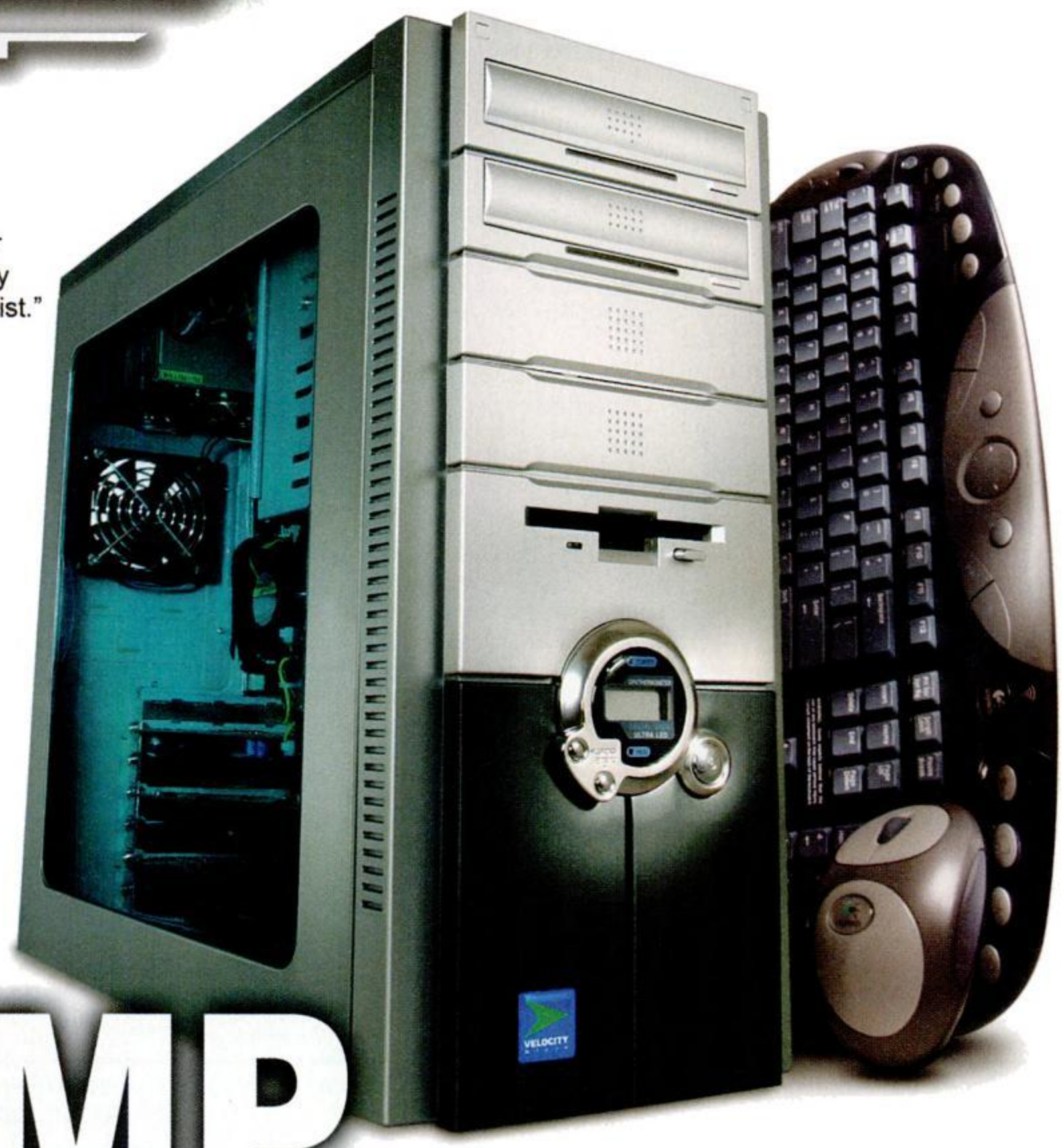

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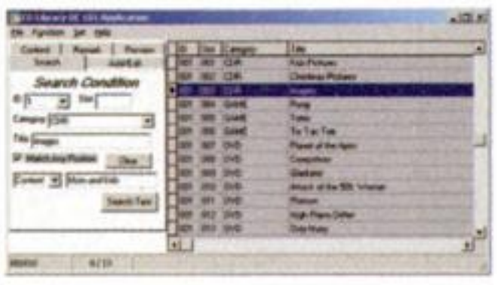

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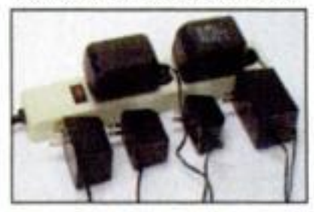

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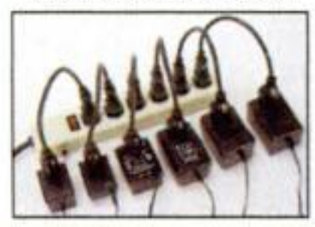

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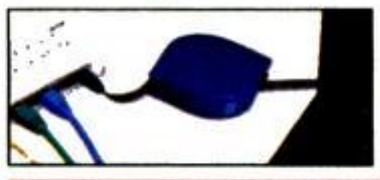

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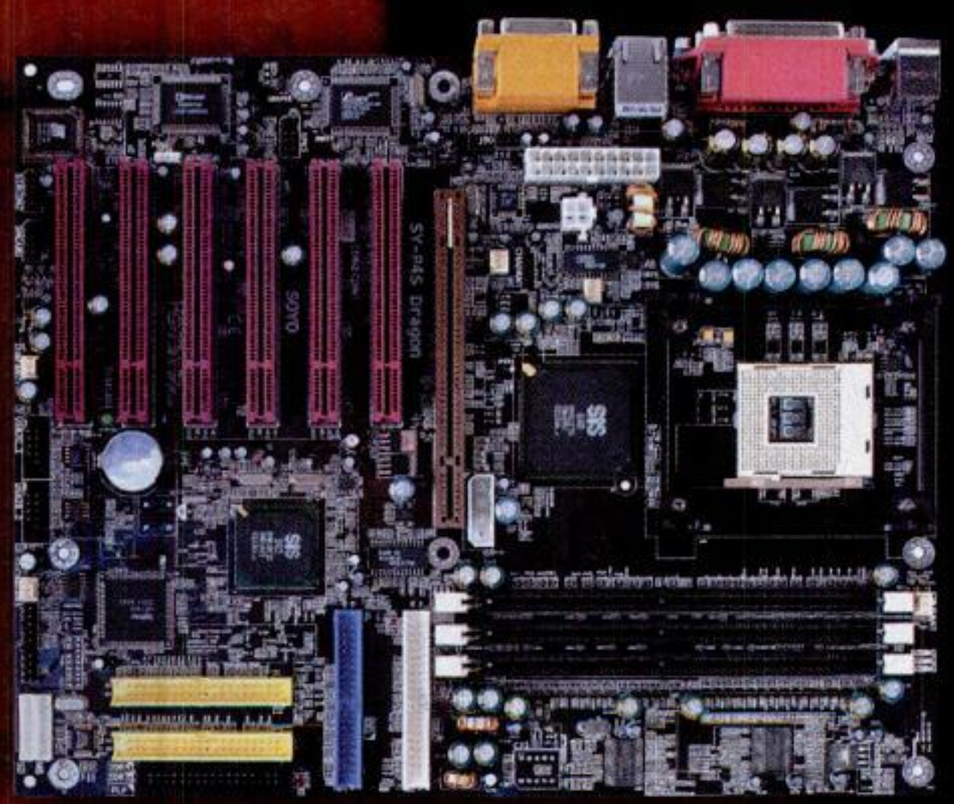

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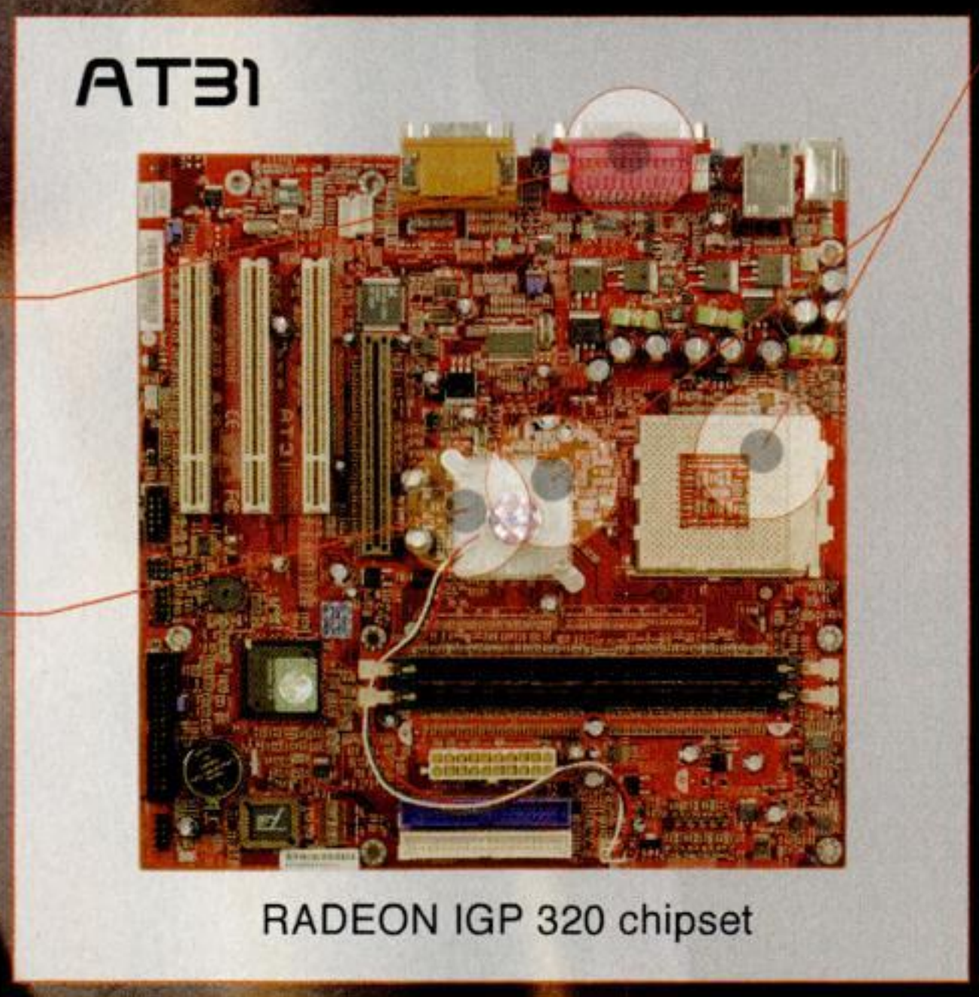

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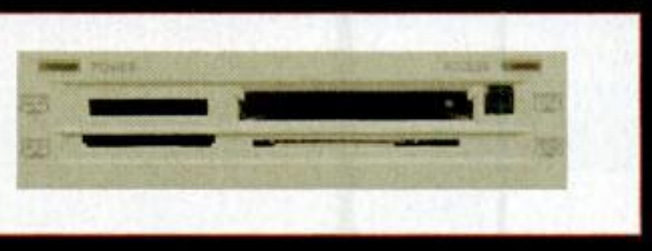

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MODEL/ SPECS	Bare Bone	Dimension W.D.H	I/O ports	5.25"	3.5"	PCI	PCI ISA
105LPX socket 370	255	12x13x3.1	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO, GAME	1	1/1	3 or	0
105LPX TV	275	12x13x3.1	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO,GAME,TV	1		3 or	0
107S37	395	5.75x6.2x1.9	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO,GAME	1slim	0/1slim	0	0
111M.NLX 370	260	11.5x10.6x2.5	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO, GAME,1394	w/slim CD	0/2.5 HD	2 or	0
192 M.ATX 370	185	13.8x16.5x3.4	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO,GAME	1	1/1	3 or	0
192B M.ATX 370	185	13.8x16.5x3.4	PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO,GAME	1	1/1	3 &	0

Case Specification & Price List

Model	Price	Dimension W.D.H.	MB Size	5.25 Ext./Int.	3.5 Ext./Int.	P.S.
R02/BARE	180/300	19x17.6x3.5	M.ATX	1/0	1/1	150W
R04B/W	275	19x24.3x3.5	ATX	1/0	1/3	250W
R05B	430	19x242x3.5	ATX	1/0	1/4	430W
R06B	250	19x20.2x5.25	ATX	4/0	1/5	300W
R08 B/W	1550/1800	19x22x3.5				
R14 B/W	215	19x21x7	ATX	3/0	1/3	300W
R15	295/510	19x24.4x7	ATX	6/0	2/2	300W
R16 B/W	225	19x18x7	ATX	3/0	1/2	250W
R17 B 4U	215	19x21x7	ATX	3/0	1/2	250W
R20 B/W	275	19x20.5x7		8/0		300W
R21 B/W	275	19x18x7		8/0		300W
R26R/B/W	630/850	19x22.6x10.7	ATX	4/0	2/4	300W/R
R28	290	19x17x8.7		8/0		300W
RSP	18	5.8x9.3x1.6			1	
RSM169-100	65/75	5.8x9.3x1.6			1	
001B	75	10x11.5x3		1/0		60W
001B1	65	8.3x10.6x2.8		1/0		50W
002B	88	6.9x14.6x5.8		2/0		60W
002B1	78	7.5x11.2x6.5		2/0		80W
004B	105	6.8x15.3x9.3		4/0		230W
004B1	100	7.5x17.3x10.2		4/0		200W
007B	180	7x15.8x13		7/0		250W
008B	280	8.4x20.2x18.3		8/0		300W
008B1	180	7.5x17.9x17.1		8/0		250W
105LPX/TV	255/275	11.9x12.6x3	LPX	1/0	1/1	90W
107 bare	395	5.75x6.2x1.9		1slim/00/1slim		
111N bare	260	11.6x10.6x2.5	M.NLX	1/0	0/1	100W
192M.ATX/B	85	13.1x16.5x3.5	M.ATX	1/0	1/1	150W
224	75	17.4x18.8x6.1	ATX	3/0	2/2	230W
267	70	16.8x16.8x6.2	ATX	2/0	2/1	250W
271	85	17.3x15.9x5.5	ATX	2/0	1/1	250X
288	75	16.9x17x6	ATX	3/0	2/1	230W
304	70	7.9x18.8x13.9	ATX	3/0	2/1	300W
325B	55	8x18.5x17	ATX	3/0	2/1	235W
338	55	7x14.7x13.8	M. ATX	2/0	2/1	145W
366	50	7.2x15.5x14.3	M. ATX	2/0	1/1	235W
367	55	7.7x16.5x17	ATX	3/0	2/1	235W
370	80	8.3x17.3x16.1	ATX	3/0	2/2	250W
392	80	7.5x17x17	ATX	3/0	2/2	250W
393	90	9x17.5x17.5	ATX	6/0	1/1	250W
401	110	8.5x17.3x18	ATX	2/0	2/2	250W
404	105	8x18.8x17	ATX	4/0	2/2	320W
405B	75	7.8x17.5x17.2	ATX	4/0	2/2	320W
409	295	9.5x22x18.1	ATX	4/0	2/5	300W
411	67	7.2x17.2x16.8	ATX	4/0	2/1	250W
412	67	7.2x17.2x16.8	ATX	4/0	1/2	250W
413BL	67	8.5x19.5x18	ATX	4/0	2/1	250W
415	75	8.8x19.5x19.7	ATX	8/0	1/0	300W
418B/W	115	8.1x18.8x21.4	ATX	4/0	2/4	300W
422	70	7.7x16.6x18.1	AT	4/0	1/4	250W
424	70	7.5x18.9x16.7	ATX	4/0	2/1	250W
426B/W/S	70/75	7.5x17.5x19.3	ATX	3/0	2/2	250W
427	75	7.5x16.5x17.3	ATX	3/0	2/2	250W
430 BL/BK	220	8.25x19.75x18	ATX	4/0	3/6	300W
436	70/85	8.6x18x15.6	ATX	3/0	2/2	250/300W
443	75	8x18.8x17	ATX	4/0	2/2	300W
467	75/90	7.5x16.7x18.8	ATX	3/0	1/4	250W/300W
470	110	8.3x17.3x21.3	ATX	4/1	1/2	250W
471	110	8.4x17.5x21.3	ATX	3/1	1/4	250W
472	60	7.5x18x17.6	ATX	4/0	2/2	250W
474	285	7.8x17.2x17.2	ATX	4/0	2/2	300W
476	70	8x17.2x17	ATX	4/0	2/2	300W
477BL	75	8.75x17.5x17	ATX	4/0	2/2	300W
478	155	7.9x18.4x16.4	ATX	4/0	2/1	300W
480	195	7.8x18x16.5	ATX	4/0	2/1	300W
482B	80	7.8x19.8x17.5	ATX	4/0	2/2	250W
486	67	9.6x19.5x17	ATX	4/0	2/1	250W
487B/W	105	8.25x18.4x21.25	ATX	4/0	2/4	300W
489**	80	7.3x17x17	ATX	3/0	1/2	235W
492	229	8.3x19.5x17.6	ATX	4/0	3/5	300W
493B	234	8.3x19.5x17.6	ATX	4/0	3/5	300W
494	229	8.3x19.5x17.6	ATX	4/0	3/5	300W
496	60	8.25x17.8x16.5	ATX	4/0	1/3	250W
501	155	8.25x17.2x23.8	ATX	4/0	2/4	300W
503R/B	455	14.8x20.4x18.4	ATX	8/0	2/4	300RW
503/B	295	14.8x20.4x18.4	ATX	8/0	2/4	300W
505	555	14.6x23x26.8	ATX	12/0	1/8	300W
505R	670	14.6x23x26.8	ATX	12/0	1/8	300RW
518	145	8.1x18.5x26.5	ATX	6/0	2/6	300W
524	380	13.9x25.6x19.1	ATX	7/0	1/2	300RW
526B/W	105/120	7.5x17.5x24.5	ATX	6/0	1/4	250W/300W
528	95/110	7.5x16.5x24.8	ATX	6/0	1/5	250W/300W
536	93/108	7.8x17x24	ATX	5/0	1/5	250W/300W
560/R	290/445	15x24.5x23.5	ATX	11/0	2/4	300W/300R
562/R/B/W	250/470	8.7x17.9x26.8	ATX	9/1	1/0	300W/300R
563/RB/W	145/370	8.7x17.9x26.8	ATX	10/0		300W/300R
565	185	9.25x18.3x21.2	XEON/ATX	4/0	2/4	300W
569B/W	210	13.5x17.8x14	B/ATX	6/2	0/8	300W/300W
570/R	150/370	8.3x17.3x26.4	ATX	7/1	1/2	300W/300R
571/R	160/370	8.3x17.3x26.4	ATX	6/1	1/2	300W/300R
582	105/120	7.8x16.5x23.2	ATX	6/0	2/1	250W/300W
588	99/114	7.8x16.5x23.3	ATX	5/0	1/3	250W/300W
592	315	8.2x23.5x23.5	ATX	6/0	3/6	300W
1620/R	950	16.5x20.3x34.3	F/ATXx2	16/0		300R

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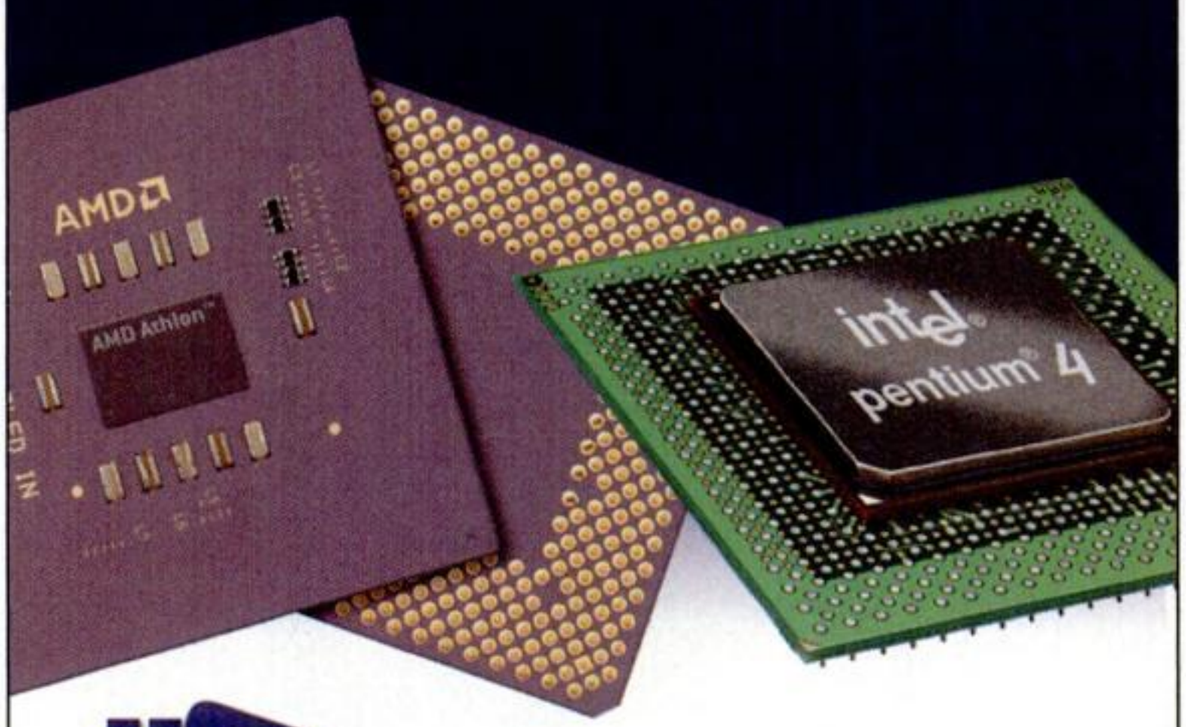

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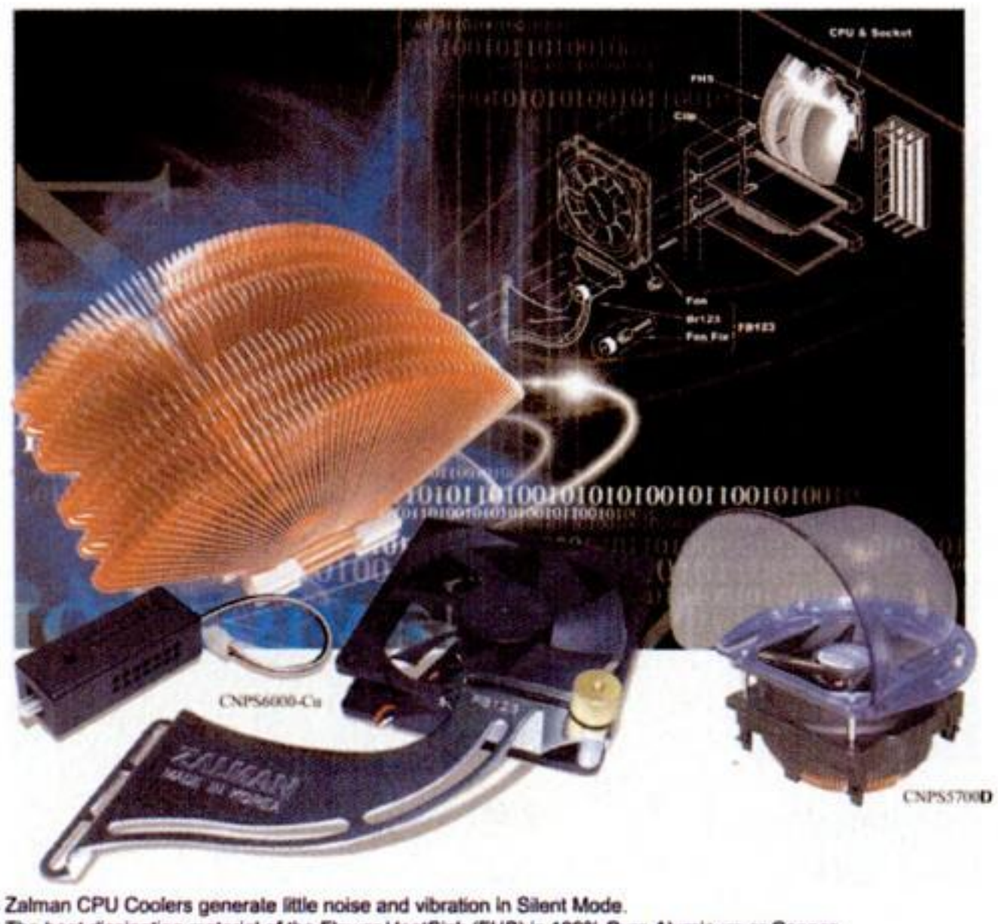

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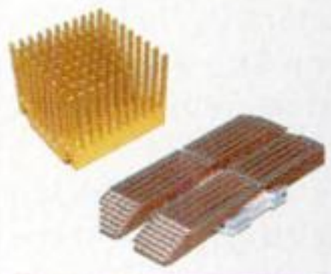

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MAXIMUMPC Rig of the Month

THIS MONTH: Sheffield Abella's Hellraiser Puzzle Box

Call it a remarkable display of ingenuity or a brazen flaunting of evil, but either way you put it, this box is *bad.* Inspired by Clive Barker's horror classic *Hellraiser,* Sheffield Abella carefully crafted a Plexiglass replica of the the movie's demonic prop—the Puzzle Box—to house his custom PC. In the movie, the Puzzle Box is a receptacle for man's dark side. In Sheff's case, we were happy to find something a little less creepy...

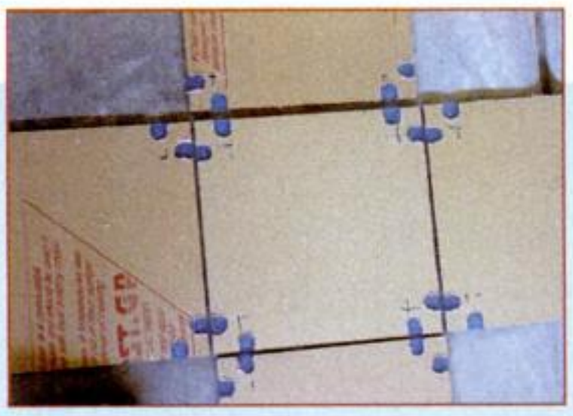
MPC At 10x10-inches, that's a small box. It must have taken careful planning to get everything in there.
I built a full-size mock-up of the box out of Gatorfoam, and taped photocopies of the components to the sides so I could get a clear picture of where things would go. Doing the Gatorfoam box enabled me to solve design issues that I hadn't anticipated.

MPC Did you have any prior experience machining parts?
Yes, a little bit from college. There was a required class where you had to build a plastic box, but I wanted to build this box with as little work as possible. I didn't want to cut grooves for the binning connectors—the metal jobbies holding the sides together—but the acrylic in that color wasn't available in the thickness I wanted, so I had to cut grooves.

MPC Describe the lighting in the box.
There is a strip of Electroluminescent Tape on the underside of the box that goes around the base. There are two blue LEDs on each of the fans. I replaced the LEDs of the power and hard drive indicators with higher-intensity LEDs. I designed the box so that, if lit from the back, light would reflect throughout the inside.

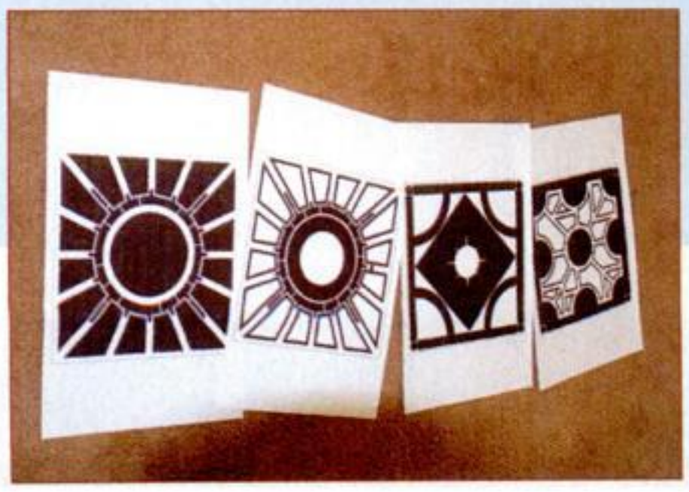
MPC Do you get nervous about releasing evil when you eject a CD?
Nah, I haven't had much of a problem with the undead. I've found that if you leave them alone, they'll pretty much leave you alone.

Strangely, Sheff's favorite game isn't *Undying*—he's actually a *Red Faction* man.

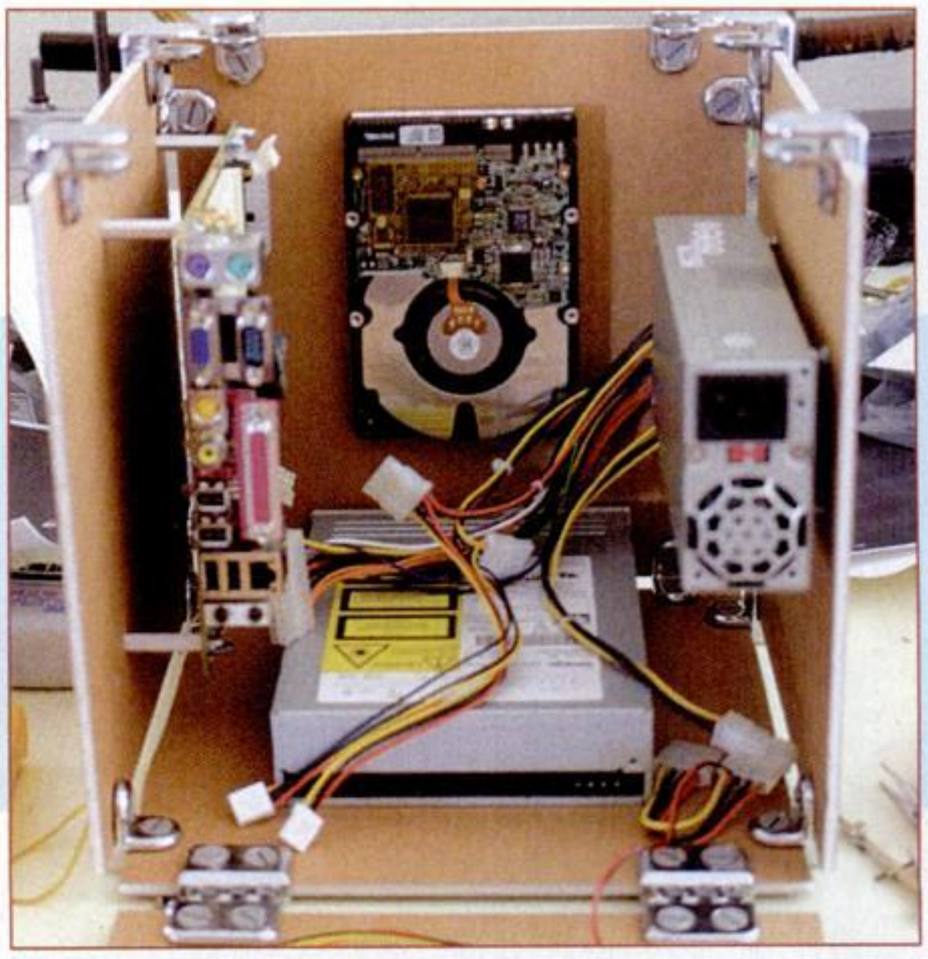


Details about the building of the Puzzle Box can be found at www.sheff.com.

Sheff's Puzzle Box includes a Shuttle FV24 Flex ATX MB, a 1GB P-III Coppermine, a 40GB Western Digital HD, a TDK 24/10/40 CD-RW, and 512MB RAM. The onboard sound needn't be an issue for too long—there's *one* open PCI slot.



With a little web research, Sheff was able to find authentic Puzzle Box patterns. "That thing is pretty damn evil once you learn the meaning behind the symbols, so I made some changes to make it nicer."



If you have a contender for Rig of the Month, e-mail **input@maximumpc.com** with pics and a brief write-up.

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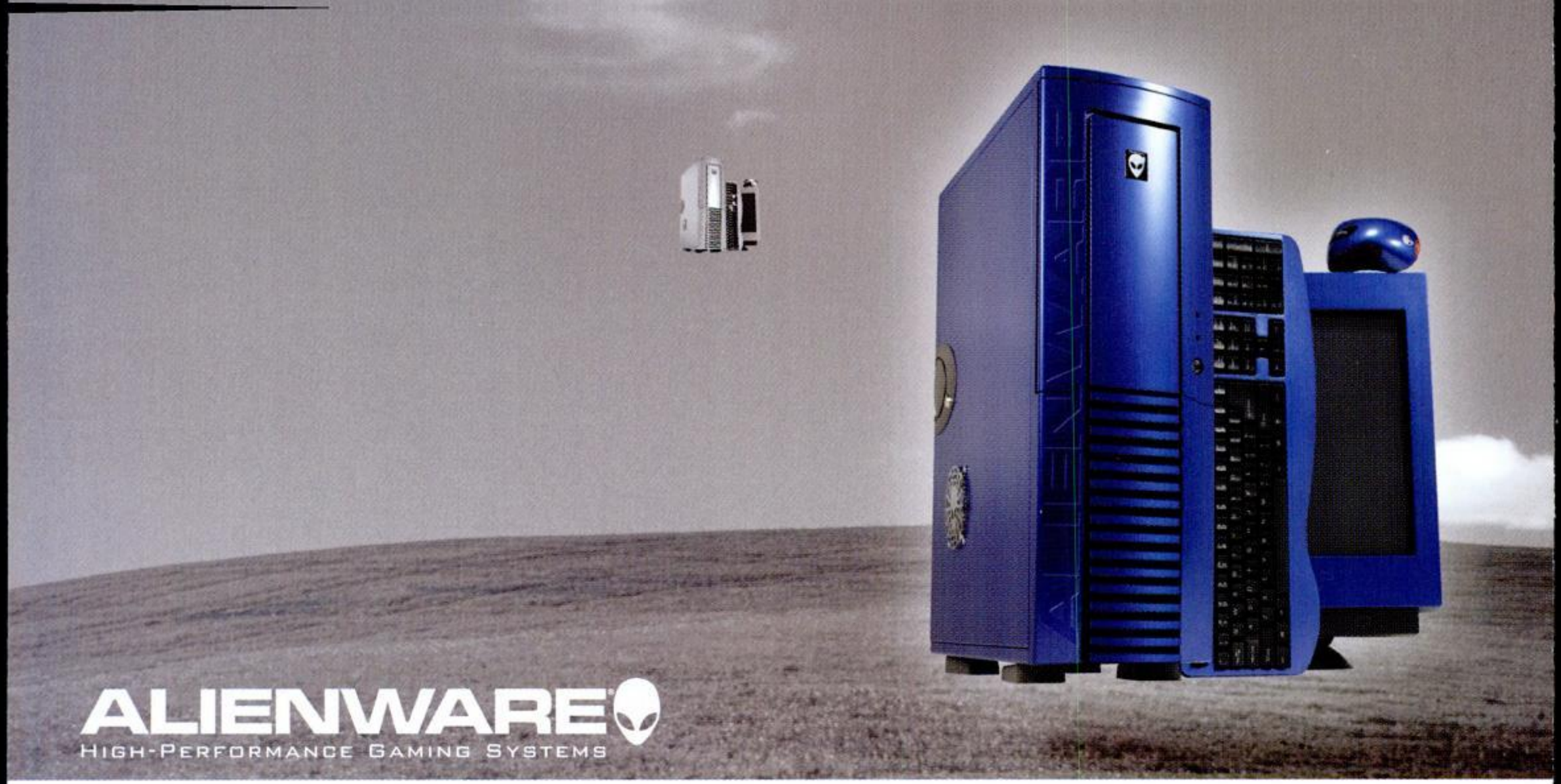

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- Maximum PC, July 2002

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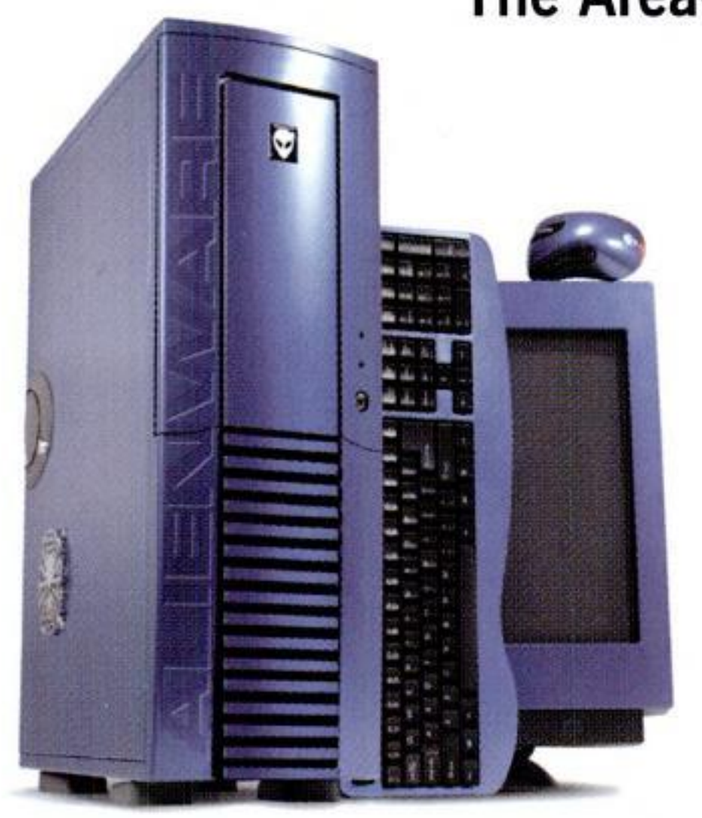

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- Maximum PC, August 2002

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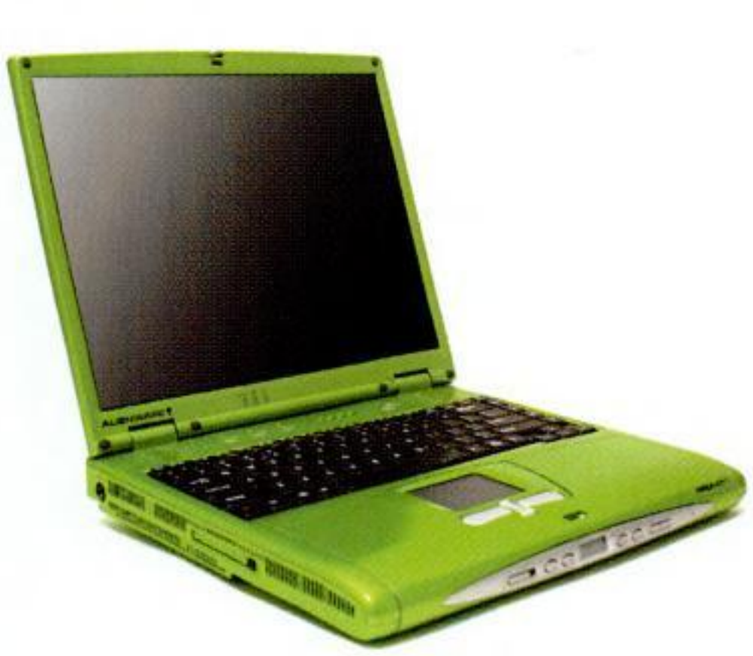

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